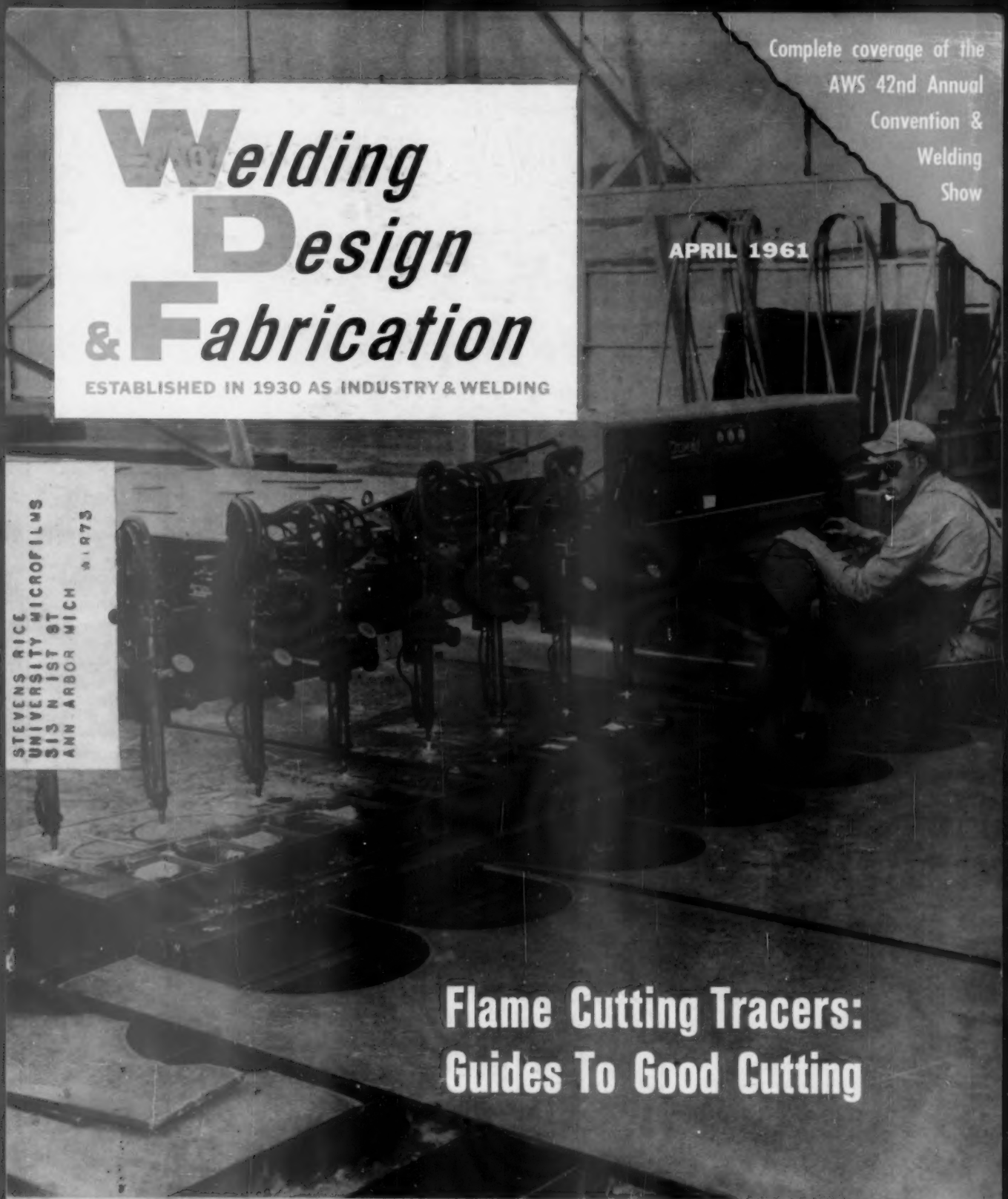

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APRIL 1961

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Straight Shell Vulcanized Fiber
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H-90AP

Straight Shell Fiber Glass
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H3-A

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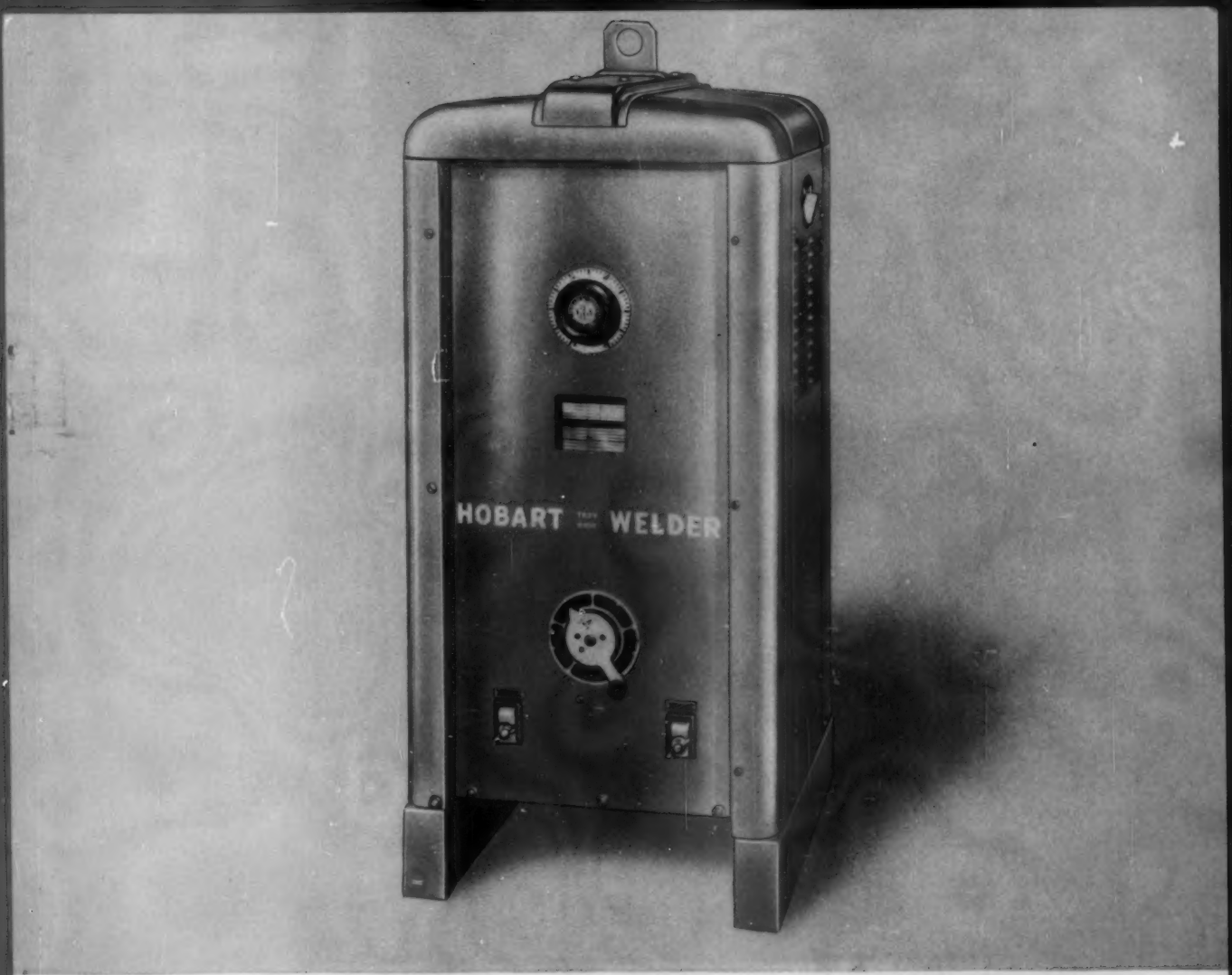

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*AMZIRC is also known as N-4.

reader's guide to

for April, 1961

COVER: Symbolic of the rapid growth of flame cutting and the striking developments in equipment is this Linde CM-50 coordinate-drive machine. The electronic tracer floats over an accurate, economical line-drawing template. And because it's all automatic, the operator can give full attention to what's going on at the cutting torches. For a complete report on tracing devices, and the flame cutting machines they are used on, be sure to read the article starting on page 52.

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FEATURES

47 WELDING WILL REPLACE MECHANICAL FASTENERS IN AEROSPACE INDUSTRIES
Here are the facts brought out by a 10-year forecast of trends and requirements just released by the Aerospace Industries Association.

48 PRESTRESSED STEEL BEAMS REPLACE CONCRETE
Here's how one state applied the principles of prestressing to steel bridge beams and used them in a 200- by 30-foot continuous prestressed I-beam bridge.

52 FLAME CUTTING TRACERS: GUIDES TO GOOD CUTTING
A survey of up-to-date flame cutting tracing devices, including the latest electric eyes. The tracers are classified. So are the machines on which they are used.

56 THE RIGHT WAY TO JOIN DISSIMILAR METALS
You can weld, braze, or braze-weld dissimilar metals if you pay close attention to joint design, filler metal, stresses, corrosion, expansion differential, and code requirements.

59 STAINLESS FILTER TAMES CORROSION
Filters are being made from metals that withstand heat, corrosion, and pressure. Here's how one company makes them from stainless steel for chemical processing.

61 STUD WELDED SHEAR CONNECTORS: NEW KEYS TO CONSTRUCTION STRENGTH
Laboratory tests show the effectiveness of ½-inch diameter welded stud shear connectors. This may lead to lighter, stronger, more economical designs for bridges and buildings.

64 MIG SPOT WELDING OF ALUMINUM IS IN; RIVETING IS OUT!
A 2-year research program shows MIG spot welding can be used instead of riveting on nonstructural aluminum products. It eliminates layout, drilling, punching, and bolting.

70 WILL YOUR NEXT CAR HAVE A ONE-PIECE BRAZED STAINLESS BLOCK?
Stainless stampings are furnace brazed to make a single-unit block, including cylinders, and head for a 175 hp water-cooled 4-cylinder engine.

76 THE PLASMA ARC CAN NOW BE USED FOR WELDING AND WELD SURFACING
The plasma arc process had been used only for plating and cutting. New developments now make it possible to use the process for welding and weld surfacing.

82 ELECTRONIC BRAIN CONTROLS WELDING OF UNITIZED BODIES
Electronic scanner makes sure no two welding machines fire at the same time. It also makes sure each welding machine gets the same amount of current each time it welds.

85 DESIGNERS! DON'T OVERLOOK ON-THE-JOB STRESS RELIEVING
Preheating and stress relieving have assumed a new importance since high-carbon and alloy steel weldments are going to work in high heats and high pressures.

88 CO_2 WELDING: A STRONGER, LIGHTER BUILDING
The CO_2 process requires fewer passes and less weld metal; it makes welded joints that are strong enough to resist dead-, live- and wind-loading.

90 SPOTLIGHT ON FABRICATING
A series of case histories show how welding fabricators are making welded products for American industry.

DEPARTMENTS

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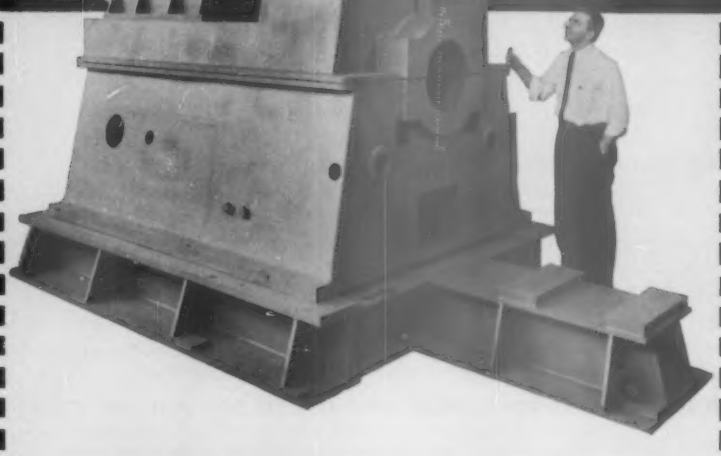
Fabricating Precision Saves 25% to 35% of Secondary Machining Costs

....on this Steel Mill Shear Housing Assembly



Most heavy weldments are fabricated with 3/8″ to 1/2″ excess material to allow for secondary finishing operations. Here at Steel Fabricators Company, we work to 1/8″ to 1/4″ allowance! Figure what that can mean to you in terms of savings on machining and scrap loss!

Take the 5-piece shear housing assembly for automatic steel mill lines which is shown above. We built 6 of them. The work involved developing intricate sections, cold forming 1″ plate (we can cold form anything up to 7″ thick), and cutting 12″ plate (we can flame cut up to 24″ plate). The gear housing sections on top were kerosene tested to assure oil-tight seams. The total weight of the assembly was about 9 tons (we can handle 15 ton weldments).

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Made to accommodate Cescoweld glass lenses or CESCO Plasti-Weld plastic filters 4½" x 5¼", the 401-17 has over twice the viewing area of regular helmets. This increased visibility, especially in the downward viewing plane, is most beneficial to wearers of bi-focal glasses. Moreover, when equipped with Plasti-Weld filters, the helmet weighs nearly one-half pound less than helmets of similar size with glass lenses and metal retainers.

Nylon headgear with broad cross strap is adjustable for height and position. Foam cushion on cross strap and brow bar provides added comfort.

***ATTENTION DISTRIBUTORS:** You're invited to inquire about CESCO's new sales and distribution policy for welding equipment distributors*

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LETTERS

to the editor

DON'T BECOME COMPLACENT

Editor:

Your special report on the *Welding Fabricator* in February was timely and informative. I was concerned at first because the lead article seemed to dwell almost entirely on the advantages of weldments over castings—and there is a lot more to the story than that. I was happy to see that the picture was completed by the remarks of Messrs. Varga, Johnson, and Austin and by the impressive and effective collection of case histories.

It seems to me that the welding industry is too young to become complacent. I can remember too well the struggles of a few years ago to get welding accepted for what we consider today commonplace applications. Yet, we seem to be satisfied to let the advances of welding occur in the welding of new and exotic materials and applications—sponsored mostly by users—while we neglect the more common but more plentiful everyday applications.

It is my opinion that 75 percent of the total welding market is being overlooked. There are the types of applications described in your report, the reclamation of worn and broken parts, more structural welding, and more effective use of welding for whatever the application.

When I see a die discarded because it has become worn, when I see extensive machining on a bar to reduce its diameter for all but a small part of its length, when I see an E6012 electrode used to weld T-1 steel, then I realize there is much left to do to get welding used to the fullest.

I hope that you will continue to use your pages to point out the job that remains to be done. It is important that welding be used fully and effectively if U. S. industry is to compete successfully with foreign competition and rising costs at home.

Simon A. Greenberg
industrial consultant
Flushing, New York

● *Need we say more?*

continued on page 8

Tempilstik° . . . temperature indicating crayons

TEMPILSTIKS° provide a simple and accurate means of determining preheating and stress relieving temperatures in welding operations. Tempilstiks° are widely used as a standard method of checking temperatures in all heat treating—as well as in hundreds of other heat-dependent processes in industry. Available in 80 different temperature ratings . . . . . $2.00 each.

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For More Information Circle No. 98 on Reader Service Card.

How flame spraying can pay for itself in your shop in a very short time

ONE EXAMPLE
Hard facing time cut from 4 hours to 25 minutes

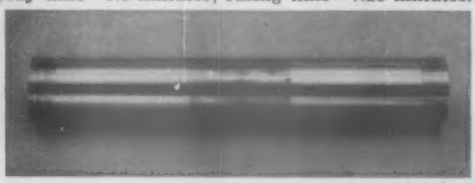
unretouched photo

The two end sections of this shaft have been built up with AMS 4775. Section at left applied by welding – time 4 hours; section at right by flame spraying – time 24 minutes, 45 seconds.

QUESTION: Look at the picture. Which end would you prefer to grind finish?

Here's the whole story. We took a 15" length of 2.5" mild steel shafting and undercut two 5" sections .050" on the radius. We then sent the shaft to a nationally-known job shop with instructions to apply AMS 4775 on the left-hand section, sufficient to finish at 2.5". Weight of welded-on alloy was 17 9/16 ounces – time spent by one of their top men – 4 hours (including preparation).

Then we blasted the second section with steel grit and flame sprayed it with AMS 4775 in powder form (ThermoSpray Powder 15E). The coating was then torch-fused. Weight of deposited alloy – 11 5/16 ounces; surface preparation, set-up and pre-heat – 12 minutes; spray time – 5.5 minutes; fusing time – 7.25 minutes.



unretouched photo

Finish-ground shaft – welded section at left, flame sprayed section at right.

We then sent the shaft out to a grinding shop with instructions to clean up at 2.500" plus. The flame-sprayed section cleaned up at 2.510" but welded section still showed pits when grinding was stopped at 2.477" Rockwell of welded end Rc-61, sprayed end Rc-60.

Pump plunger being flame sprayed with METCO ThermoSpray® Powder Gun

These flame-sprayed coatings are solid, homogeneous; usually superior to those applied by other methods. You can apply them at high speed, with lower material and finishing costs. In addition to AMS 4775, a number of other powders – including tungsten carbides – are available for various service requirements; all may be fused–some used as sprayed for certain service requirements.

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For More Information Circle No. 74 on Reader Service Card.

LETTERS TO THE EDITOR

continued from page 6

REQUEST FOR TEAR SHEETS

Editor:

In your November, 1960, issue there is an article ("Sea Will See More Aluminum Boats") of which I would like six additional copies.

In the same issue there is an article entitled "Does A Radiographed Vessel Cost More To Build Than One That Isn't?" I would also like six copies of it.

C. W. Myers
chief inspector
Burgess-Manning Company
Dallas, Texas

Editor:

In your November, 1960, issue an article entitled "Does a Radiographed Vessel Cost More to Build Than One That Isn't" appeared. Our rather extensive technical library of books and periodicals here in the Engineering Department does not have this publication.

Would you please forward a reprint of the above article as soon as possible? If for some reason a reprint is not available, please send the entire issue.

R. W. Cookson
design draftsman
Du Pont
Wilmington, Dela.

● *Tear sheets of these articles and any others appearing in WD&F are available as long as they last.*

PERFORATING IS PERFECT

Editor:

I would like to tell you how much I appreciate the perforated pages in your magazine. It certainly makes it easier to tearout specific articles and file them away for quick reference. Too bad more technical magazines don't do the same.

Glenn Miller
Sterling Drilling Company
Brighton, Michigan

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BY

A.O. SMITH

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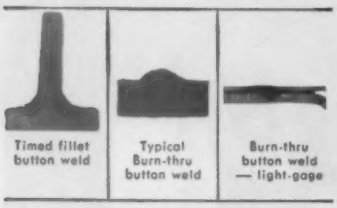
Choice of nozzles permits welding of any of the standard joints (lap, fillet, butt).



Timed fillet button weld | Typical Burn-thru button weld | Burn-thru button weld — light-gage

Other button blessings include quality low-hydrogen weld metal, high deposition rates, full utilization of weld metal for low overall costs. Put this high-speed production tool to work for you. Send for Bulletin MW-253 for details.

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LIBRARY

of welding

Directory of Fabricators

"Directory of Steel Fabricators" from Steel Plate Fabricators Association, 105 W. Madison Street, Chicago 2, Illinois, $10.00.

This directory lists 250 firms that are doing heavy steel plate fabrication. These are listed alphabetically by state, with the names of principal officers, address, and telephone number.

Guide to Nickel Alloys

"Physical Properties of Some Nickel-Base Alloys" by M. E. Lanston and C. H. Lund, Battelle Memorial Institute, for Office of Defense Research and Engineering, May, 1960, 146 pages. Order from OTS, U. S. Department of Commerce, Washington 25, D.C., $2.75.

This is a guide to the physical properties of 33 representative nickel-base alloys. It contains two major subdivisions. The first is a tabulation of chemical composition which classifies the 33 alloys into six groups according to the type and amount of major alloying constituent. These are: nickel-copper; nickel-silicon; nickel-chromium; nickel-chromium-iron; nickel-chromium-cobalt; and nickel-molybdenum.

The second section contains definitions of the terms used to describe the alloys' physical properties, a survey of available data, and data sheets and graphs for each of the representative alloys. A typical data sheet gives a brief description of the alloy, its phyiscal properties, producers, and a list of references from which the data was obtained.

The report is not intended for use as a design manual. Most of the data is typical and some is preliminary.

Platinum Alloys

"Investigation of the Heat Resistance of Alloys of Platinum with Rhodium, Iridium, Ruthenium, Chromium, and Aluminum by the Bend-Test Method" from OTS, U. S. Department of Commerce, Washington 25, D. C., September, 1960, 9 pages, 50 cents.

This is the translation of an article from Doklady Trudy Instituta Metallurgii imeni A. A. Baykov (Reports of the Institute of Metallurgy imeni A. A. Baykov), No. 5, Production Metallurgy, Physical Metallurgy and Physiochemical Methods or Research, Moscow, 1960. I. I. Kornilov and R. S. Polyakova.

inspect PANDJIRIS MACHINE TOOLS FOR WELDING

...compare with all other production welding equipment.

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BOOTH 420 right off escalators

SEE PANDJIRIS
- welding head manipulators
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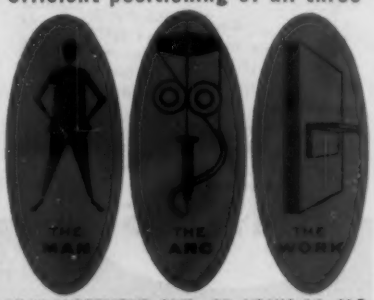
PANDJIRIS WELDMENT CO.

efficient positioning of all three



5151 NORTHRUP AVE., ST. LOUIS 10, MO.
ask for technical literature
Circle No. 81 on Reader Service Card.

18 HOURS IN A CEMENT MIXER...

(And $1.93 put it back in working condition.)

How much of a battering can a torch take and still keep working? Here's a test which Smith's engineers devised to find out just how rugged Smith's new heavy duty torch is:

The torch was tossed into a turning cement mixer where it clanked and flopped for 18 consecutive hours. At the end of that time, they stopped the mixer and removed the torch.

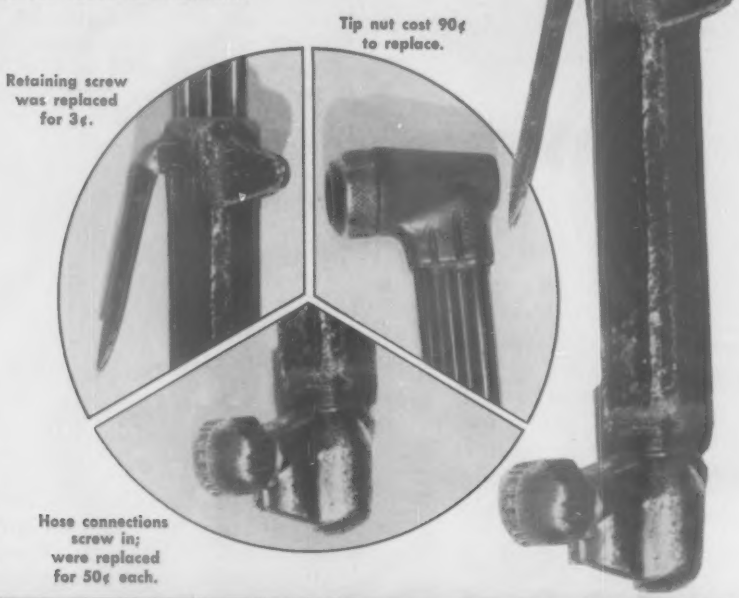
Damage? The retaining screw on the cutting lever had dropped out (cost 3¢); hose connections had broken off (they're removable by design and cost 50¢ each); and the tip nut was out of round (cost 90¢). The photos show the scars of battle.

The point is that by replacing a retaining screw, two hose connections, and a tip nut, the torch was back in operating condition. Total cost: $1.93.

You may never have occasion to give your torch a trip in a cement mixer, but whether you're a burner or a bill payer, down time and repair costs can hurt. This torch can cut them to a minimum.

The best part of the story is that for fast, efficient cutting, this torch is unsurpassed, whether for 24 gauge or 24 inch steel. We call it "Tuf-Tony, the Metaleater." Ask your Smith distributor for a demonstration or write for more information:

New! 4-color wall charts showing flame traits of oxy-acetylene and oxy-LP gas in cutting, welding and brazing. Your's for the asking. See your Smith distributor or write Smith's.



SMITH'S

SMITH WELDING EQUIPMENT CORPORATION
2633 Fourth Street S.E., Minneapolis 14, Minnesota

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A MAJOR TECHNICAL ADVANCEMENT

EPA 7000-4

AC and DC ARC WELDING from 3 PHASE INPUT

VICKERS Controlarc®

Vickers research and development of new and better welding apparatus has again culminated in another Vickers "first" in the welding industry . . . Now, the only AC-DC Arc Welder designed to use three-phase input power for both AC and DC output . . . The Controlarc 330.

The advanced features of this new machine are enhanced with a full complement of standard Controlarc accessories, which provide: correction for line voltage variation, full range foot rheostat tapering of welding current, dual-continuous control. Vickers slope controller provides automatic DC or AC current programming over the full range of the machine.

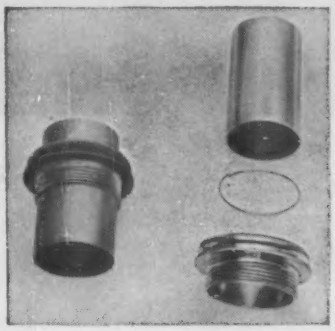
Call your Controlarc welding dealer or write for complete information.

Welding Dealers: Some territories available—visit our booth at the AWS Show.

VICKERS INCORPORATED
Division of Sperry Rand Corporation
ELECTRIC PRODUCTS DIVISION
1855 LOCUST STREET • SAINT LOUIS 3, MISSOURI

Every Hour M. S. Little Brass Goods Company Makes 650 Appliance Fittings Better With HANDY & HARMAN SILVER BRAZING

Rotating jig showing mounted assemblies entering and leaving gas-air furnace.



Left– brazed assembly. Right– components with preform ring of EASY-FLO *45.*

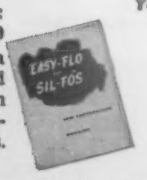
This Hartford, Connecticut, company makes—in volume—an assembly that goes into the overflow system of household appliances. The assembly consists of brass tubing and a machined brass casting. The two components are joined by a preplaced ring of Handy & Harman EASY-FLO 45 silver brazing alloy and HANDY FLUX. Heating is automatic gas-air; parts are placed on a rotating turntable to pass through the gas furnace. Every 60 working minutes, 650 assemblies are completed.

The advantages here are that the manufacturer can use thin-walled tubing with heavier, threaded components at no sacrifice in strength. Because of EASY-FLO's penetrating qualities, the entire shear area is fully as strong as the solid parts of the assembly, yet considerably lighter. And, casting and machining the components for this assembly have been greatly simplified.

Are you in pursuit of a metal-joining method which offers—among other advantages—high, uninterrupted production at low capital investment? You may easily find the answer in Handy & Harman silver brazing. Hundreds of manufacturers and fabricators of as many different products, parts and components are right now enjoying the speed, economy, strength and *flawlessness* of brazing. You can too. Just ask Handy & Harman, 850 Third Ave., New York 22, N. Y.

FOR A GOOD START: BULLETIN 20

This informative booklet gives a good picture of silver brazing and its benefits... includes details on alloys, heating methods, joint design and production techniques. Write for your copy.



Your No. 1 Source of Supply and Authority on Brazing Alloys

HANDY & HARMAN

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New York, N. Y.
Providence, R. I.
San Francisco, Calif.
Montreal, Canada
Toronto, Canada

For More Information Circle No. 48 on Reader Service Card.

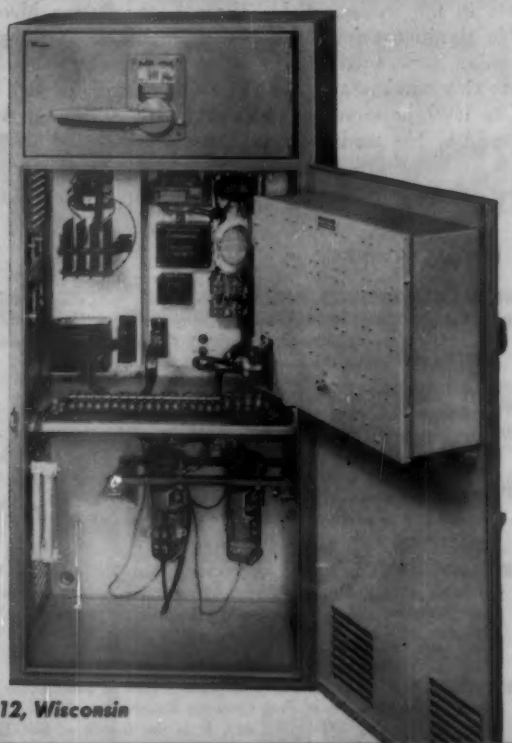
BETTER WELD QUALITY! LESS MAINTENANCE!

with SQUARE D NORpak WELDER CONTROL

Industry's FIRST Transistorized Standard Resistance Welder Control

MAINTENANCE IS PRACTICALLY NON-EXISTENT

because ***NORpak*** static control elements replace control tubes in the logic panel, eliminating the most common cause of trouble. ***NORpak*** transistorized units have no moving parts to wear, no filaments to burn out. They are encapsulated in epoxy resin for protection from atmosphere and physical damage, and are guaranteed against defects for one year. Versatility of ***NORpak*** units makes it easy to provide any special sequence required.



BETTER WELD QUALITY

results from greater timing accuracy. ***NORpak*** welder control is available with either resistor-capacitor timing circuits or cycle-counting circuits for absolute accuracy. Timing is not affected by normal line voltage fluctuations because of a built-in regulated power supply.

EASY-TO-HANDLE COAXIAL IGNITRON TUBES

are smaller, have higher peak current capacity, and are plastic-coated for greater safety.

OPTIONAL DISCONNECT SWITCH

available in 200 or 400-ampere rating, fusible or non-fusible. Power wiring is easy, and NEMA terminal markings are used throughout.

GET THE COMPLETE STORY...

Write Square D Company, Dept. SA, 4041 North Richards Street, Milwaukee 12, Wisconsin

SQUARE D COMPANY

wherever electricity is distributed and controlled

For More Information Circle No. 95 on Reader Service Card.

Smith Wins IAA's Morehead Metal

BOSTON: Elmer H. Smith, founder and current chairman of the board of Smith Welding Equipment Corp., Minneapolis, will receive the James Turner Morehead Medal at the International Acetylene Association's 63rd annual convention. The convention will be held at the Sheraton-Plaza Hotel on April 24-25.

SMITH

The Morehead Medal is awarded annually to the individual who has done the most to advance the industry or the art of producing or utilizing calcium carbide or acetylene. Mr. Smith, who celebrated his 50th year in the welding equipment business in 1959, is the holder of numerous patents in the welding field. These include significant improvements in the design and function of welding and cutting torches and tips. From 1937 to 1939, he served as president of the IAA. The medal will be presented to Mr. Smith by L. L. McBurney, past president of the IAA.

TECHNICAL SESSIONS

Technical sessions will be held during the two-day meeting. One will be on the handling of cryogenic fluids, with emphasis on their use in New England's electronic industry. Another will be on safe practices for using oxy-acetylene and oxy-acetylene equipment.

PRINCIPAL SPEAKER

Principal speakers at the opening luncheon will be Gerald W. Blakeley, Jr., president of Cabot, Cabot, & Forbes Co., Boston. Mr. Blakeley is one of the country's leading builders of industrial parks. He will speak on the problems of urban redevelopment and suburban development.

OFFICERS

Officers of the International Acetylene Association will participate in the Boston Meeting. They are J. L. Adank, National Cylinder Gas Co., president; C. G. Andrew, Air Reduction Sales Co., vice president; and R. A. Speck, Air Reduction Chemical & Carbide Co., treasurer. L. G. Matthews, Linde Company, is executive secretary.

NEWS BRIEFS

AMERICAN CRYOGENICS, INC., has leased the compressed and liquid gas manufacturing facilities of Victor Equipment Company at La Habra and Sacramento, California. Under a recent agreement, American will produce the gases sold by Victor in the retail market in California.

NOOTER CORPORATION of St. Louis has received a contract to fabricate the reactor vessel for an $8,000,000 nuclear development facility being built by General Electric Co. at Vallecitos Atomic Laboratory near San Francisco. The 80-ton pressure vessel will house a superheat reactor. The vessel itself is designed for a pressure of 1250 psi and 650°F. It will be 7-feet in diameter, 25-feet long, and its 3½-inch-thick steel shell will be lined on the inside with stainless.

SCIAKY BROS., INC., is moving its Research Division from Los Angeles to their recently enlarged plant facility in Chicago. The move is being made to centralize and integrate research and development work with the main plant's laboratory and manufacturing activities.

A LINDE-BUILT liquid oxygen-nitrogen plant is now in production supplying rocket engine development facilities at Fort Crowder Reservation, Neosho, Missouri. The new plant has a capacity of 140-tons a day. It is the fourth of five Linde plants designed to meet the needs of the nation's aerospace program.

ALLOY RODS COMPANY now has direct factory representation in Cleveland, Ohio. The company has established a warehouse-sales center for its complete line of welding electrodes and wires. It's located at 215 Brookpark Road.

more news on page 38

About RWMA

by **SIMON FISHER**
president
Resistance Welder Manufacturers' Association

The Resistance Welder Manufacturers' Association has as its primary objective sponsorship of activities directly beneficial to its membership of 15 leaders in the manufacture of resistance welding equipment and to the industry as a whole.

However, an increasingly active area of interest has involved RWMA in cooperative ventures with groups outside RWMA but with parallel interests.

- RWMA carries a sustaining membership in the American Welding Society and holds at least two joint meetings yearly with AWS.
- Through its technical committees and by direct financial aid, RWMA sponsors several important projects through the Welding Research Council. Among these, currently, are a Seam Welding Fellowship at the University of Texas. Other programs on specialized problems have been conducted at Rensselaer Polytechnic Institute and Ohio State University.
- RWMA holds membership in the American Standards Association, and the work of the ASA Sectional Committee C88 is under RWMA guidance and financial support.
- The work of a joint RWMA—National Electrical Manufacturers' Association committee recently resulted in publication of the new NEMA Standard for Resistance Welding Control.
- RWMA has also worked closely with the Resistance Welding Alloy Association in reviewing and approving its new numbering system.

continued on page 122

NOW, a single source for AUTOMATIC HARD SURFACING MACHINES and WIRES

Here's news on how you can zero in all your Hard Surfacing needs on one single target . . . The McKay Company has acquired Automatic Welding Company, one of the nation's leading manufacturers of automatic hard surfacing machines. This new McKay-Automatic Welding team is a natural to serve all your hard surfacing needs. You have one convenient source for the most efficient and economical wires for automatic and semi-automatic hard surfacing, plus the finest automatic welding machines for rebuilding and/or hard surfacing all types of construction, mining and general industrial equipment. No matter what your hard surfacing needs, you can bank on the know-how and experience of this one convenient source.

The McKay Company and Automatic Welding Company will exhibit at the AWS Welding Show

SEE REVERSE SIDE FOR FLOOR PLAN OF AWS WELDING SHOW

Both will have live demonstrations in Booth 222

AUTOMATIC WELDING COMPANY

A Subsidiary of THE McKAY COMPANY

1008 Liberty Avenue Pittsburgh 22, Pa.

LIVE WELDING DEMONSTRATION AT McKAY BOO

During the A.W.S. Welding Show, visitors will be able to witness the perform of McKay Electrodes and Automatic Welding Wires under simulated job c tions. Skilled welders will demonstrate the inherent operational character which make these products outstanding in those applications where economy weld metal quality are important factors.

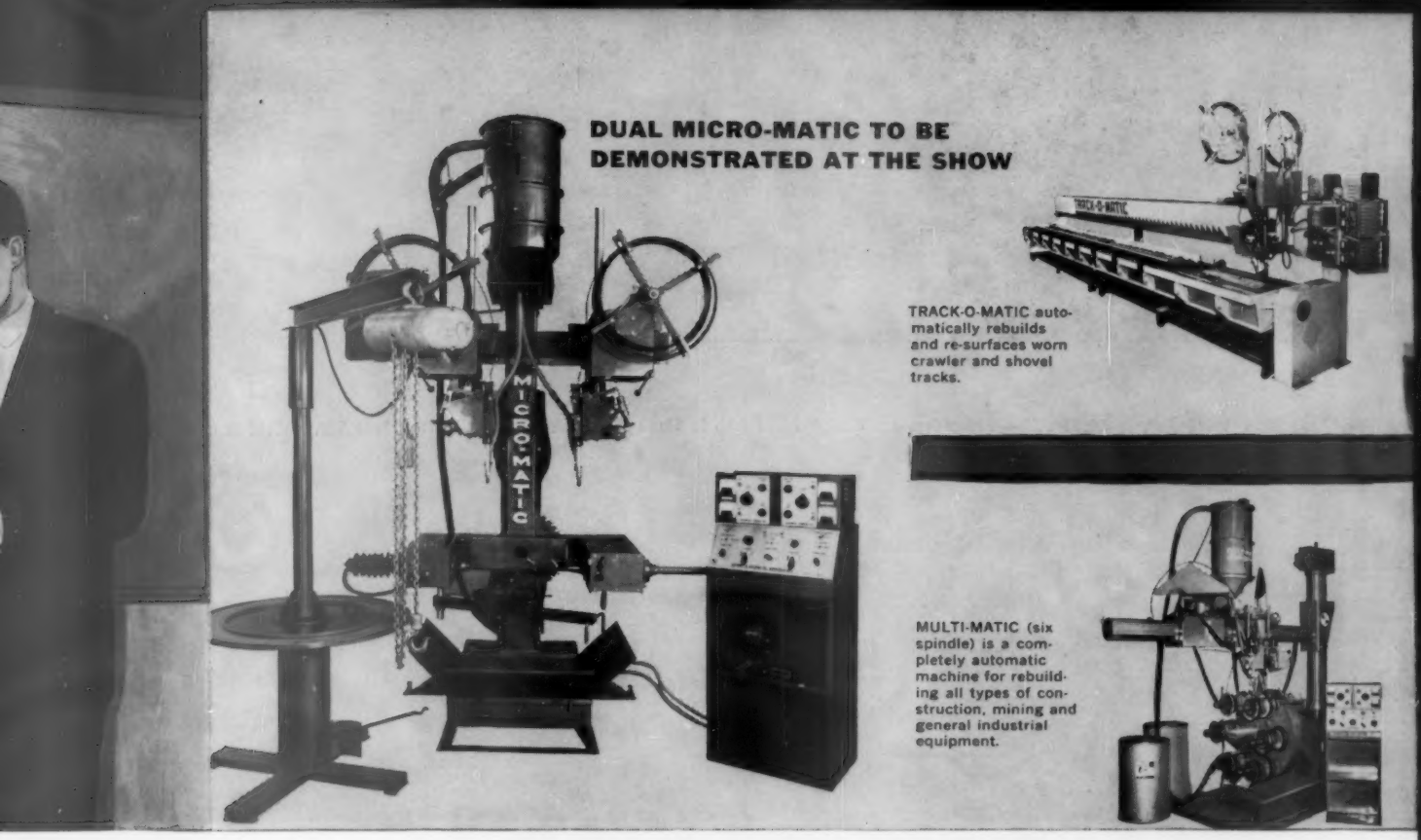
Be sure to see these demonstrations and learn how you can profit by u McKay welding products in your welding or surfacing operations.

Available at the McKay exhibit will be experienced technical and field r sentatives to answer questions on welding techniques and problems, and to pr complete information on McKay's complete line of Mild Steel, Low Hydr Stainless Steel and Hard Surfacing Electrodes and Welding Wires.

SEND FOR CATALOGS
Write direct or circle on Readers Service Card
No. 1 for Hard Surfacing Catalog
No. 2 for Welding of Stainless Steels
No. 3 for Welding of Mild Steels

THE McKAY COMPANY

1008 LIBERTY AVENUE PITTSBURGH 22, PA.


DUAL MICRO-MATIC TO BE DEMONSTRATED AT THE SHOW
MICRO-MATIC
TRACK-O-MATIC automatically rebuilds and re-surfaces worn crawler and shovel tracks.
MULTI-MATIC (six spindle) is a completely automatic machine for rebuilding all types of construction, mining and general industrial equipment.

BOOTH

rformance
job condi-
acteristics
nomy and

by using

eld repre-
to provide
Hydrogen,

SEE DUAL MICRO-MATIC MACHINE IN OPERATION AT AUTOMATIC WELDING COMPANY'S BOOTH

Automatic Welding Company's DUAL MICRO-MATIC Rebuilder is designed for fast, economical resurfacing of idlers, rollers and wheels for tractors, cranes and shovels. The DUAL MICRO-MATIC has two heads. Each is mounted on an independent travel carriage that moves in either direction. Each also has its own, motorized vertical lift adjustment. A "Lazy Susan" turntable and pivoted loading arm handles rollers easily and quickly in and out of the welding station. Tractor idlers are conveniently loaded into the welding station with the jib crane. *The yoke holds the complete idler assembly without dismantling.*

To answer any questions visitors might have about Automatic Welding's products, including the MULTI-MATIC and TRACK-O-MATIC shown above, a team of Automatic Welding Company representatives will be standing by. They will be happy to discuss any automatic welding equipment needs or problems. Their experience and knowledge in automatic welding should be of great help to visitors looking for sound solutions to difficult automatic welding and surfacing problems.

AUTOMATIC WELDING COMPANY
A Subsidiary of THE McKAY COMPANY
1008 Liberty Avenue Pittsburgh 22, Pa.

SEND FOR PRODUCT BULLETINS

Write direct or circle on Readers Service Card
No. 150 for Micro-Matic Bulletin
No. 151 for Multi-Matic Bulletin
No. 152 for Track-O-Matic Bulletin

Welding Design & Fabricatio

EXHIBITORS

COMPANY	BOOTH
Airline Welding & Engineering	706
Air Reduction Sales Co.	320, 321
Alloy Rods Company	601
All-State Welding Alloys Co., Inc.	529
Alphil Spot Welder Mfg. Corp.	717
Aluminum Company of America	631
American Brazing Alloys Corp.	630
American Machine & Foundry Co.	209
American Pullmax Company, Inc.	200
Ampco Metal, Inc.	103
Arcair Company	727
Arcos Corporation	521
Aronson Machine Company	700
ARO Spot Welder Corporation	612
Automatic Welding Company	222
Balteau Electric Corp.	531
Bay State Abrasive Products Co.	501
Beeco Manufacturing Co.	721
Bernard Welding Equipment Co.	220
Branson Instruments, Inc.	130
Bren Weld Corporation	400
Brunmar Commercial Corporation	110
Cam-Lok Division of Empire Products, Inc.	221
Coast Metals, Inc.	202
Contour Product Corporation	227
Cosa Corporation	300
Coyne Cylinder Company	228
Dockson Corporation	703
Earth Equipment Corp.	707
Emerson Electric Mfg. Co., Inc.	713
Engelhard Industries, Inc.	712
Eutectic Welding Alloys Corp.	134
Hamilton Electrona, Inc.	231
Hancock Gross Mfg., Inc.	229
Exomet, Incorporated	124
Falstrom Company	711
Fenway Machine Company	131
Fibre-Metal Products Co.	616
Flood Safety Products Co.	109
Frommelt Industries	117
General Dynamics Corporation, Liquid Carbonic Div.	304
General Electric Company	404
Glendale Optical Company	507
Gregory Industries, Inc.	237
Handy & Harman	312
Harnischfeger Corporation	617
Harris Calorific Company	634
Harper Trucks, Inc.	629
Hobart Brothers Company	315
Independent Engineering Co., Inc.	602
International Nickel Co., Inc.	217
Jackson Products, Division of Air Reduction Co., Inc.	332
Kaiser Corporation	705
Lenco, Inc.	113
Lennox Tool and Machine Builders	128
KSM Products, Inc.	423
Lincoln Electric Company	520
Linde Company, Division of Union Carbide Corporation	421

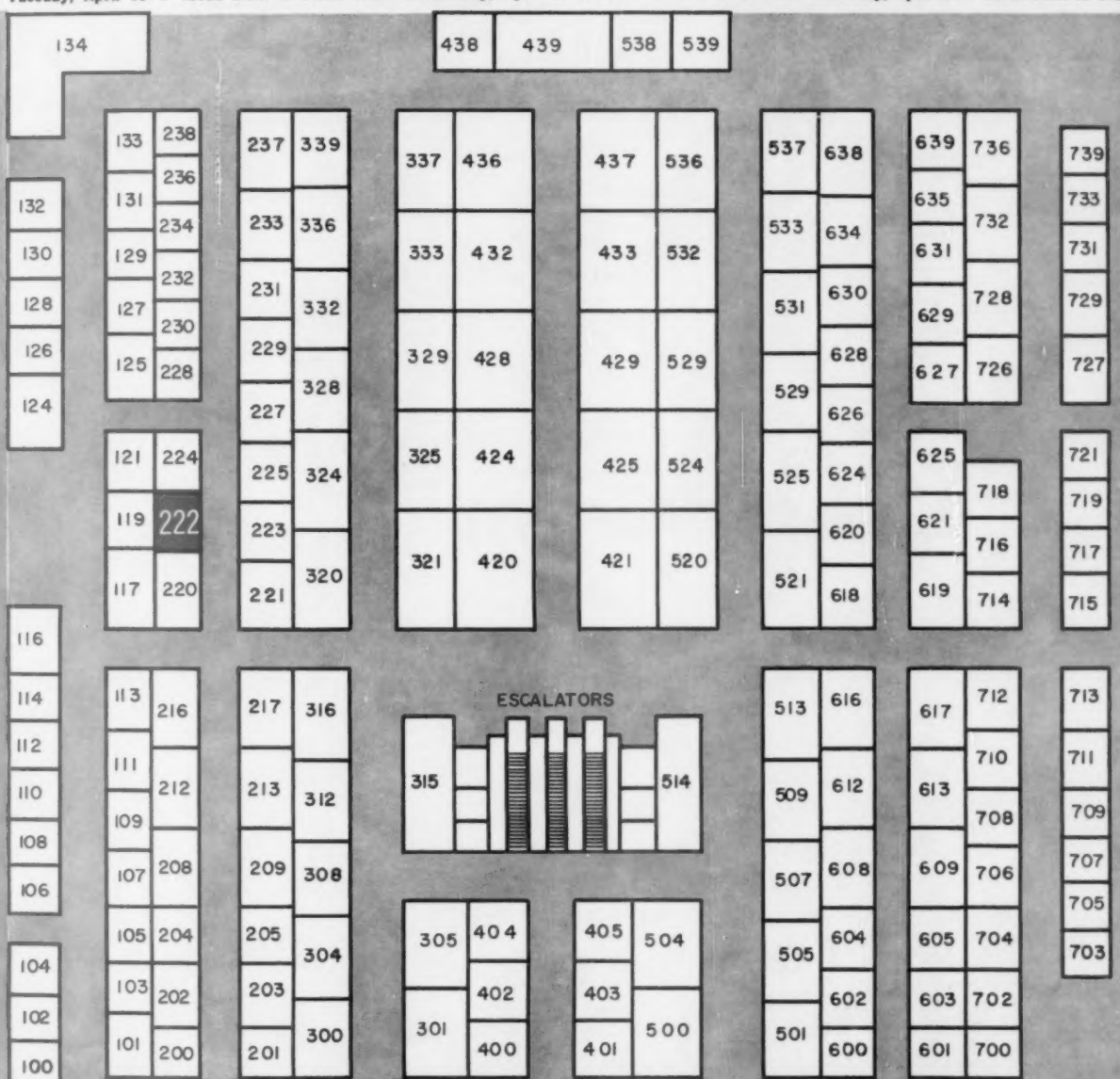
COMPANY	BOO
McKay Company	
Magnaflux Corporation	
Marindus Company	
Markal Company	
Marquette Mfg. Company	
Martin Wells, Inc.	
Messer Cutting Machines, Inc.	
Metal & Thermit Corporation	
Metallizing Company of America	
Metco, Inc.	
Mid-States Welder Mfg. Co.	
Miller Electric Mfg. Co.	
Milwaukee Electric Tool Corp.	
Modern Engineering Company	
Natural Cylinder Gas Division of Chemetron Corporation	436, 437,
National Electronics, Inc.	
National Torch Tip Company	
Omark Industries, Inc.	
Page Steel & Wire Division of American Chain & Cable Co., Inc.	
Pandjiris Weldment Company	
Philips Electronics, Inc.	
Picker X-Ray Corporation	
Precision Welder & Flexopress	
J. M. Ragle Industries, Inc.	
Ransome Company	
Reid Avery Company	
Rexarc, Incorporated	
Robotron Corporation	
Robvon Backing Ring Company	
Sciaky Bros., Inc.	
Secheron Works Co.	
Sellstrom Manufacturing Co.	
Simonds Abrasive Company	
Singer Glove Mfg. Company	
A. O. Smith Corporation	
Sperry Products Company	
Square D Company	
Steffan Manufacturing Corp.	
Stoody Company	
Sylvania Electric Products, Inc.	
Tec Torch Company, Inc.	
Tempil Corporation	
Thomson Electric Welder Co.	
Tin-A-Lum Division of Metals for Industry, Inc.	
Toyomenka, Inc.	
Tweco Products, Inc.	
Uniflex Cable Division, Gar Wood Industries, Inc.	
Unique Equipment, Inc.	
Vickers, Incorporated	
Victor Equipment Company	
Wall Colmonoy Corporation	
Welding Alloys Mfg. Co.	
WELDING DESIGN & FABRICATION	
Weld Tooling Corp.	
Welduction Corporation	
Welsh Manufacturing Company	
Weltronic Company	
Wespo Division, Ylier Engineering Corp.	
Westinghouse Electric Corporation	
Wheelabrator Corporation	

Guide to AMERICAN WELDING SOCIETY'S 4

APRIL 17-21 / NEW YORK C

FLOOR PLAN/2nd FLOOR/NEW YORK COLISEUM

Tuesday, April 18 • 10:00 A.M. to 10:00 P.M.—Wednesday, April 19 • 10:00 A.M. to 10:00 P.M.—Thursday, April 20 • 10:00 A.M. to 6:00 P.M.



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42nd ANNUAL MEETING & WELDING SHOW

COLISEUM / NEW YORK CITY

TECHNICAL PROGRAM

APRIL 17-21 • HOTEL COMMODORE • NEW YORK CITY

APRIL 17, MONDAY

10:00 A.M.—Official Opening and Business Session
CHAIRMAN—J. E. Dato, Linde Company
ADDRESS—R. D. Thomas, Jr., President, AWS
NATIONAL AWARDS
ADAMS LECTURE—Studies on Cracking of and Transformation in Steels During Welding, by H. Granjon, Institut de Soudure, France

AFTERNOON

THREE SIMULTANEOUS SESSIONS, 2:00 P.M.
(SPONSORED BY INTERNATIONAL INSTITUTE OF WELDING)
1. Processes 2. Welded Structures
3. Alloy Fabrication

4:30 to 6:00 P.M.
Educational Lecture Series (Part I)
Heat Sources, Heat Flow and Heat Effects in Welding
by N. N. Rykalin, USSR
CHAIRMAN
E. C. Miller, Union Carbide Nuclear Co.

APRIL 18, TUESDAY

THREE SIMULTANEOUS SESSIONS, 9:30 A.M.
(SPONSORED BY A.I.E.E. ELECTRIC WELDING COMMITTEE)
4. Resistance Welding 5. Brazing
6. Arc Welding

AFTERNOON

THREE SIMULTANEOUS SESSIONS, 2:00 P.M.
7. Arc Welding 8. Brazing 9. Applications

4:30 to 6:00 P.M.
Educational Lecture Series (Part II)
Heat Sources, Heat Flow and Heat Effects in Welding
by N. N. Rykalin, USSR
CHAIRMAN
E. C. Miller, Union Carbide Nuclear Co.

APRIL 19, WEDNESDAY

TWO SIMULTANEOUS SESSIONS, 9:30 A.M.
10. Welded Structures
(SPONSORED BY INTERNATIONAL INSTITUTE OF WELDING)
11. Arc Welding
(SPONSORED BY A.I.E.E. ELECTRIC WELDING COMMITTEE)

AFTERNOON

TWO SIMULTANEOUS SESSIONS, 2:00 P.M.
12. Weldability
(SPONSORED BY INTERNATIONAL INSTITUTE OF WELDING)
13. Resistance Welding

2:00 to 4:00 P.M.
Missiles and Rockets Welded Fabrication
MODERATOR
D. B. Howard, ACF Industries, Inc.
PANELISTS
D. W. Kinsey, U. S. Steel Corp.
R. D. Libert, A. O. Smith Corp.
J. W. Jakubowski, General Electric Co.
J. F. Rudy, Armour Research Foundation

APRIL 20, THURSDAY

THREE SIMULTANEOUS SESSIONS, 9:30 A.M.
14. Electroslag Welding
15. Research and Weldability
16. Arc-spot Welding

AFTERNOON

THREE SIMULTANEOUS SESSIONS, 2:00 P.M.
17. Processes
18. Nuclear Components
19. Research and Weldability

APRIL 21, FRIDAY

THREE SIMULTANEOUS SESSIONS, 9:30 A.M.
20. Submerged-arc Welding
21. Gas-shielded Welding
22. Research and Weldability

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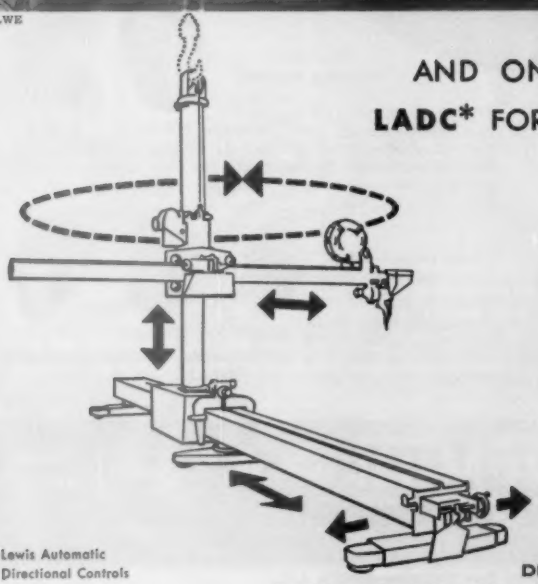
DING COMPANY
WELDING MACHINES & WIRES

8111-LWE



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LADC* FOR FULLY AUTOMATIC SEAM TRACING

LEWIS "Universal" manipulators make automatic welding *profitable* for both production and job shops. Developed by a production fabricator, they have exclusive advantages that assure maximum versatility, dependability and cost savings. You can do more . . . for less . . . with these truly "Universal" machines!

LEWIS also can furnish lightweight, portable "Bantam" manipulators for diversified small jobs and "Heavy Duty" car-type machines for the king-size jobs.

*Lewis Automatic Directional Controls

LEWIS

THE LEWIS WELDING & ENGINEERING CORP.
107 NORTHFIELD ROAD • BEDFORD, OHIO

DESIGNERS • ENGINEERS • FABRICATORS • MACHINISTS

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ALL THIS and NO EXTRA COST! Why settle for LESS?

Helmet QUALITY is FIBRE-METAL'S Trademark!

OVER 50 YEARS OF WELDING & SAFETY EXPERIENCE!

CHECK ALL THESE FEATURES FOR PROOF!

Check overall... and check detail after detail... and you'll see REAL SUPERIOR QUALITY by any comparison! These features give you *the best... the most for your money!* In value, in comfort, in convenience, in wide versatility of usefulness!

OVERHEAD ADJUSTMENT to raise or lower crown as needed... with 6-position positive lock. Easy to adjust.

NEW RATCHET ADJUSTMENT holds selected size. Designed for gloved hand. Based on Fibre-Metal design used dependably for many years. Widest headsize range!

PLASTIC MATERIAL: a) unaffected by moisture, hence no warping; b) conforms easily to all head shapes; c) easy to keep clean, to sterilize ... unaffected by detergents.

FREE-FLOATING ATTACHMENT permits headgear headband to fit all head shapes perfectly. No side helmet shell pressure on wide heads. No front-to-back pressure on narrow heads. There is no direct connection of headband to helmet shell!

ALL METAL PARTS ALUMINUM for light weight, durability, corrosion resistance (except necessary bronze and cadmium plated steel springs).

WIDE RANGE FRICTION JOINT. Long lasting, holds helmet up easily, needing only slight nod to return to operating position. Easy to adjust.

REPLACEABLE SWEATBANDS (snap buttoned!) of supremely comfortable Genuine Leather (also in simulated leather). Smooth overlap construction, no annoying wrinkles, padded.

4-POSITION HELMET STOP positions helmet for overhead and vertical welding. Easy, positive, no tools required. Allows normal raising of helmet on friction joints.

CHIN REST is adjustable to 3 positions... a real comfort feature, particularly for overhead welding. Also supports helmet shell for longer service life.

THE WELDING HELMET WITH THE WORLD'S MOST COMFORTABLE HEADGEAR!

More than 60 styles of helmets to meet all your needs

QUICK-LOK-equipped Helmet shells are available in all popular styles. Provides quick and easy shell attachment to Safety Caps or the new 3-Q Headgear!

MANY TYPES OF GLASS-HOLDERS, fixed or lift-front, of plastic, steel or Dowmetal. Rugged, light, durable... and insulated from outside to inside. Leakproof to light! All glassholder models replaceable for longer helmet life.

708-3-C 606-3-C 672-3-C 702-3-C

FIBERGLAS* Welding Helmets

FIBERGLAS shells are seamless, completely opaque†, compression molded of Fiberglas-reinforced thermo-setting polyester resin. With strengthening beaded edges, they are rugged, self-extinguishing, impervious to moisture, easily cleaned and sterilized, allow full ventilation.

666-P9 270-3-C 460-3-C

VULCANIZED FIBRE Helmets

Vulcanized Fibre Shells, seamless and fabricated, are LOWER PRICED, light in weight, "sealed" against light leakage, allow full ventilation. Other features as above!

*OWENS-CORNING TRADE MARK

†Even when non-reflective inside coating is scratched!

Bulletin No. 73 gives you complete helmet and accessory information.

ASK YOUR WELDING & SAFETY DISTRIBUTOR!

The FIBRE-METAL Products Company | CHESTER PENNA.

In CANADA: Fibre-Metal (Canada) Limited, Toronto

Visit us at THE WELDING SHOW—New York Coliseum—BOOTH 616

For More Information Circle No. 38 on Reader Service Card.

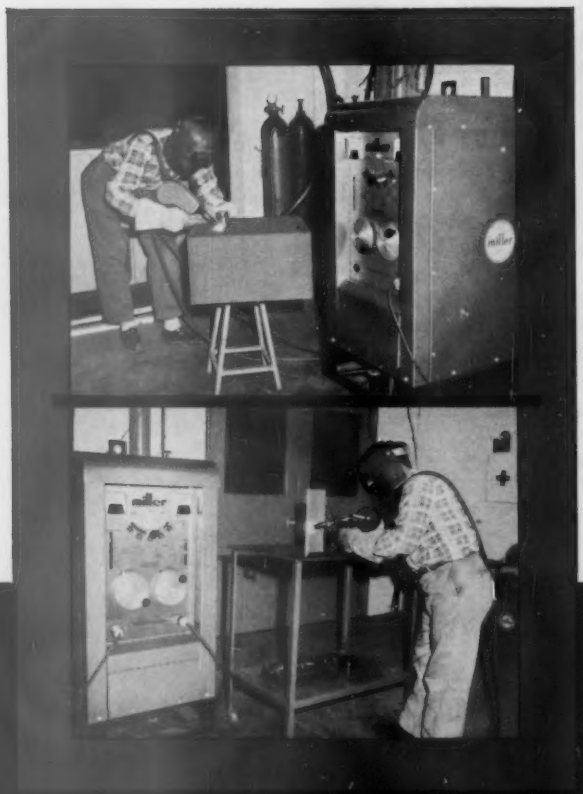
FINEST THING FOR

MIG WELDING

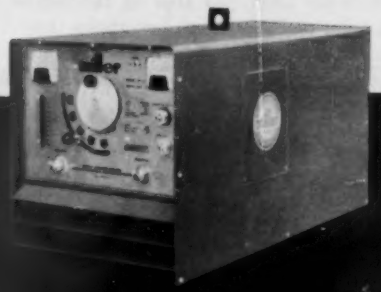
(using *any* shielding gas)

. . . is a MILLER CP-2 VS!

CP-2 VS



The Miller CP-5 illustrated below is a high output, constant potential d-c welder especially equipped to handle MIG welding applications on heavy plates and structures. This welder features five continuous adjustment voltage ranges operating from 500 amperes at 40 volts to 50 amperes at 10 volts. Slope control has fourteen positions. Convenient horizontal design is only 27½" high.



CP-5

Swift and solid success of Miller's variable slope d-c constant potential 300 ampere welder for all MIG work led to the development of the 200 ampere version shown here. Offered especially for use with recently introduced 200 ampere air-cooled guns having self-contained spools of wire, the CP-2 VS delivers:

Continuous voltage and slope adjustment • Current as low as 15 amps at 10 volts • A constant potential d-c source for heavy MIG work • Slope control with infinite continuous adjustment.

Information available upon request relating to 200 ampere CP-2 VS, 300 ampere CP-3 VS or 500 ampere horizontal model, the CP-5.

miller ELECTRIC MANUFACTURING COMPANY • APPLETON • WISCONSIN

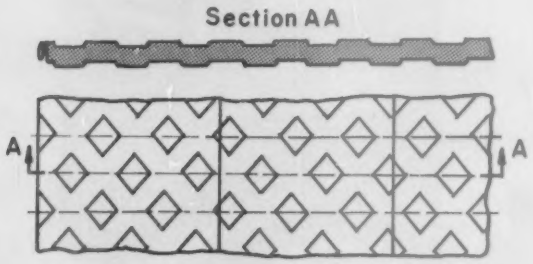
EXPORT OFFICE: 3 West 57th Street, New York 19, N.Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

For More Information Circle No. 75 on Reader Service Card.

WELDING MANAGEMENT

watches these developments

THE USSR IS DEVELOPING a wide, tubular, flux-filled electrode for building up large areas. A special machine rolls two strips into a flat tubular shape which it fills with flux. Another machine joins the elements



into an electrode of the desired width and rolls rhombic indentations into the wide sides of each element to prevent the flux from moving.

COLOR EVERYWHERE is the theme of a new color coding program designed for easy identification of welding wire. It's being used by Page Steel & Wire Division of American Chain & Cable Co., Inc. The company had been printing bright identifying color strips on cardboard coil liners. Now it is doing the same on all forms of its welding wire packaging. Page uses a specific color for each grade of wire and two colors in some cases. This color is used on the cardboard coiler liner and also on the special labels for all spools, reels, cartons, Leverpaks, and Payoffpaks containing the same grade. All labels contain information on size, grade, order number, heat number and weight.

A QUANTITY PRICING PROCEDURE has been introduced by Babcock & Wilcox's Tubular Products Division. The new policy, which became effective in January, is a cost-related form of pricing which has been used by a number of industries, including steel tubular products. Under the new pricing procedure, distributors will be able to carry a complete stock and provide users faster delivery. It also reduces the distributor's cost of planned stock replacement and can provide an increase in sales for out-of-stock transactions.

ANOTHER WELDING MANUFACTURER has expanded and diversified. The McKay Company, which makes welding electrodes and wires, chain, and chain products, has acquired Automatic Welding Co. of Waukesha, Wisconsin, as a wholly-owned subsidiary, according to James C. McKay, president.

The new McKay subsidiary specializes in making welding equipment for automatic hard facing. Standard production models include a completely automatic, multiple-spindle machine for rebuilding construction, mining, and general industrial equipment. Automatic Welding also makes a full range of machines for specialized automatic welding applications.

"This is a new step in our planned expansion and diversification program," said Mr. McKay. It goes hand-in-hand with the $1,200,000 expansion program for our York manufacturing facilities."

TOP AWARD in the 1960 safety contest sponsored jointly by the Steel Plate Fabricators Association and the National Safety Council was won by Lukenweld Division of Lukens Steel Co., now called the weld department of the firm's Fabricating Division. Lukenweld had a disabling injury rate of only 1.87 for every million man hours worked during 1960. This compares to a 14.06 average for competing association members. The contest was conducted in two divisions: Field Erection and Shop. Lukenweld was in Group B of the Shop Division.

FIBER METAL RESISTANCE WELDING has been developed by Armour Research Foundation. Its basic concept involves fiber metallurgy, an ARF development in which thin fibers of metal are interlocked like a felt cloth. This fiber metal sheet is placed between surfaces that are to be resistance welded. This sheet greatly increases the ratio of the contact resistance to the bulk resistance, allowing the metal in the fiber mat to reach its melting point faster, while the base metal remains relatively cold. Greater efficiency and lower power requirements are the most important of five advantages claimed for the process.

QUARTERLY BUSINESS CONDITIONS reported for the last quarter of 1960 by 191 members of the National Welding Supply Association are as follows:

	Percentage changes in dollar sales*						
ZONES	1	2	3	4	5	6	Gen. avg.
Sales - fourth quarter, 1960 compared to fourth quarter, 1959	0	3	1	7	4	3	3
Sales - for year 1960 vs. year, 1959	5	6	4	6	3	2	4
Number reporting	41	22	36	32	24	36	191

*Percentages are plus unless preceded by minus sign.

Zones are: No. 1, Eastern; No. 2, Southeastern; No. 3, Central; No. 4, West Central; No. 5, Southwestern; No. 6, Western.

Circle No. 108 on Reader Service Card. ⟶

NEW FROM WESTINGHOUSE

BALTOGRAPH 300 PENETRATES UP TO 4" OF STEEL

permits 360° radiography and can be coned down to a single beam . . . yet weighs only 136 lbs.

This is the first industrial X-ray unit designed specifically to meet *all* radiographic inspection requirements, from thin aluminum up to 4" thick steel. Simple to operate . . . requiring only a few hours instruction.

For a free demonstration—at your plant or job site—just call, wire, or write to Mr. Dan Maus, X-ray Department, Westinghouse Electric Corporation, 2519 Wilkens Avenue, Baltimore 3, Md.—*You can be sure . . . if it's Westinghouse.*

SPECIFICATIONS

X-ray Head

X-ray tube, lead shielding, HT transformer, filament heating transformer, and automatic thermal cutoff device are all mounted in a single lightweight housing.

X-ray portal: Total X-ray beam is 360° circumferential
Focus size: 3 x 3 mm
Inherent Filtration: Low
Shielding: 5 mm of lead
Power rating: Self-rectified 300 KVP-3MA
Weight: 136 lbs.
Dimensions: 46¼ long, 12¼ diameter

Control Panel

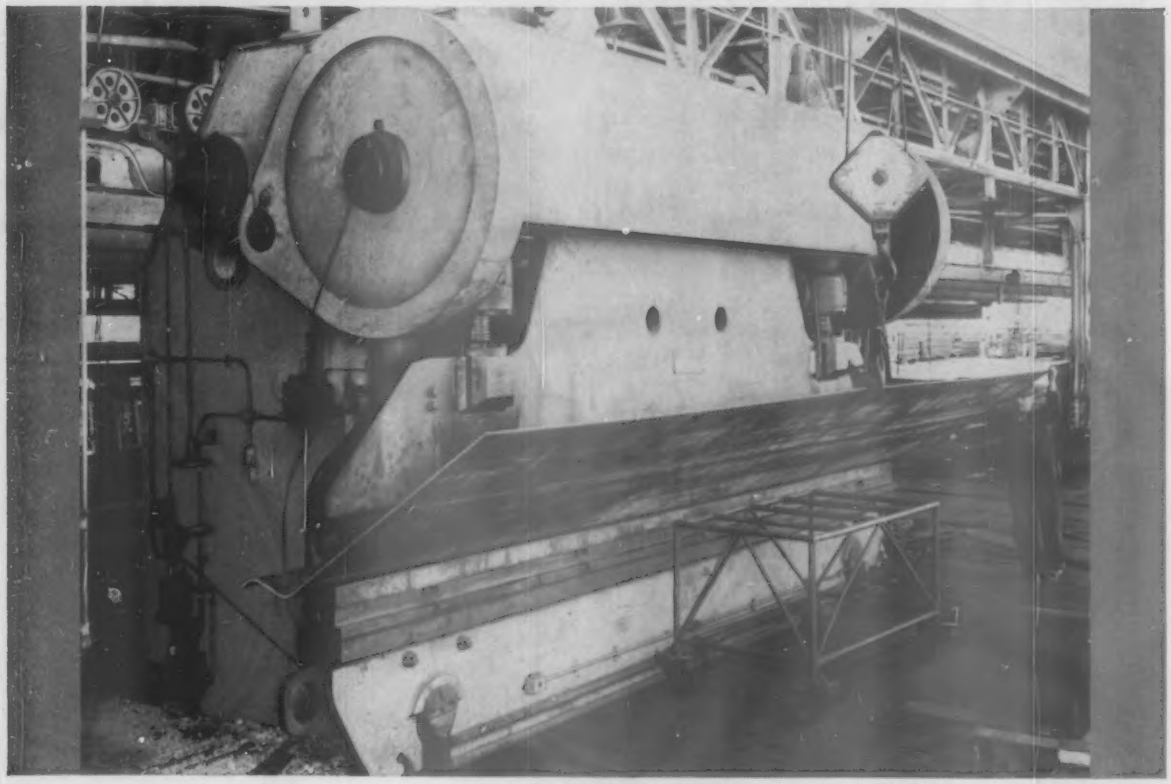
Hermetically-sealed penetration meter, penetration selector, MA control, and automatic push button reset timer mounted in rugged metal cabinet.

Power Supply: 115 or 230 volts, 60 cycles, single phase
Weight: 41 lbs.
Dimensions: 15" x 12" x 7"
Also included: 25' and 60' connecting cables and individual carrying cases.

Westinghouse

U.S.S. KASKASKIA is typical of many ships which have had extensive bulkhead and other repairs at Moore Dry Dock Company.
Official U. S. Navy Photograph

Moore Dry Dock SPEEDS MARINE REPAIRS



Fluted bulkhead plate being formed by Steelweld bending press in plate shop of Moore Dry Dock Company for bulkhead renewal job on U.S.S. "KASKASKIA" (A027). Size of plate: length 26', width 6', thickness ½".

Long a leading West Coast ship builder and marine repairs concern, the Moore Dry Dock Company, Oakland, California, has found a large Steelweld Bending Press to be a great asset in speeding the forming of heavy plate.

Ship repair, which constitutes an important part of the company's business, often requires replacement of large sections, such as bulkheads. This necessitates the forming of plates to various shapes to accurately replace those removed. Because of the power of their Steelweld and the ease of making adjustments, this work is carried on efficiently and satisfactorily.

The entire line of Steelwelds has an enviable reputation for continuous high-production performance. We urge you to get the facts on their many outstanding features.

GET THIS BOOK!
CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
9362 East 281 Street, Wickliffe, Ohio

STEELWELD
PRESS BRAKES
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

For More Information Circle No. 28 on Reader Service Card.

This Welding Goggle Fits Over All Glasses

Here are coverglas goggles—in both welders' and chippers' models—that will fit properly over *all* safety and personal glasses. These AO goggles, with 50 mm. round lenses, exceed all government specifications, simplify lens stocking with this standard size.

Both AO Super Armorplate hardened and regular unhardened lenses are available in a full range of Filterweld shades. Solid fiber lens retaining rings prevent light leaks, while individual side louvers in each eyecup provide increased ventilation. Cellulose acetate eyecups are opaque black. Two welders' models—AO329 and 329B—feature either adjustable leather or rigid bar bridges.

These same coverglas goggles, with direct ventilation and clear Super Armorplate lenses, are also available for chippers with adjustable leather or rigid bar bridges—AO325 and 325B. Either opaque or clear eyecups. For full information on both types, contact your nearest AO Safety Products Representative.

Your Surest Protection . . . AO SURE-GUARD Goggles

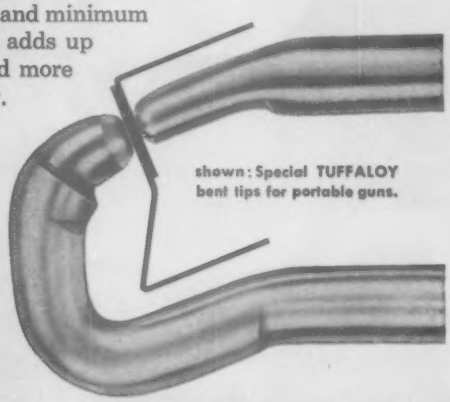
American Optical
COMPANY

SAFETY PRODUCTS DIVISION • SOUTHBRIDGE, MASSACHUSETTS

For More Information Circle No. 12 on Reader Service Card.

The Strongest Bent Tips Come From TUFFALOY

You get more spot welds for your money when you buy TUFFALOY bent tips. These electrodes are bent to precise angles so skillfully that there's no sacrifice of the wall strength needed to withstand heavy forging pressures. Examine a TUFFALOY bent-tip—the diameter remains constant and the coolant hole is unobstructed. So carefully is the job done that there's no cave-in at the outside of the bend, and minimum swelling at the sides. This adds up to longer electrode life, and more spot welds for your money.



shown: Special TUFFALOY bent tips for portable guns.

Doc Tuffy says . . . *All TUFFALOY tips keep their bright and shiny look. Oxidation is inhibited by dipping the parts in a passivation solution . . . another example of our attention-to-detail that spells extra value for you.*

Write or call your nearest AIRCO or TUFFALOY distributor for more information about TUFFALOY bent tips. Many styles are stocked as standard items, and special designs are quickly made to order. Be sure to ask for the TUFFALOY Catalog.

AIRCO®

AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated

150 East 42nd Street, New York 17, N. Y.

More than 700 Authorized Airco Distributors Coast to Coast

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For More Information Circle No. 6 on Reader Service Card.

MEN ON THE MOVE

in the welding industry

PROMOTIONS:

STUART

BOUCHER

GENCUR

MOODY

Warren Stuart has been appointed sales manager of the Belden Manufacturing Company, Chicago. Mr. Stuart has been with Belden for 15 years.

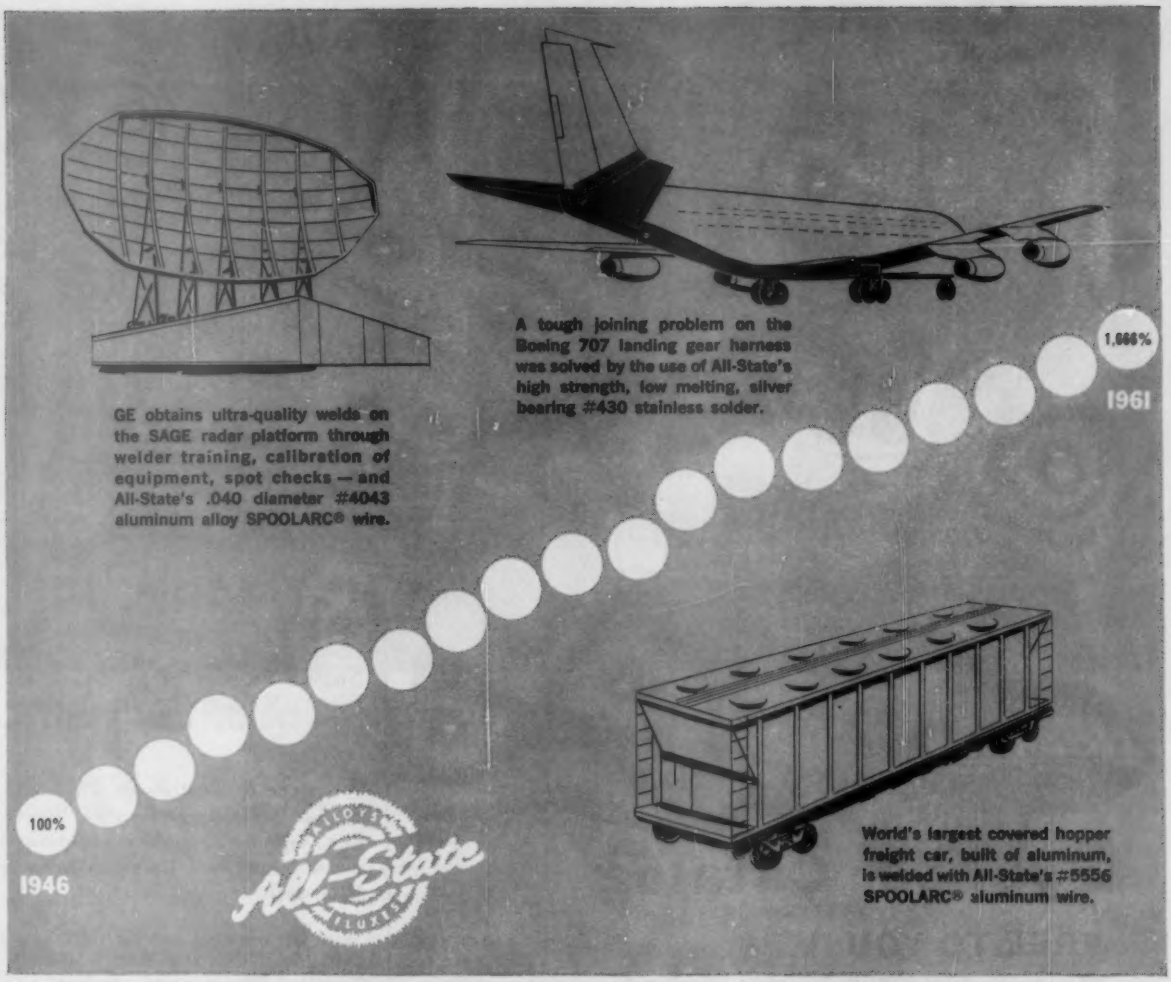
A. F. Boucher has been named general sales manager by Lincoln Electric Co., Cleveland. He succeeds **J. S. Roscoe** who will devote full time to special market development assignments.

Andrew F. (Jimmy) Gencur has been named assistant sales manager of the Finished Products Division of the Detroit Stamping Co.

N. F. Moody has been named regional sales manager of Air Reduction Sales Company's eastern region. He succeeds A. S. Blodget, who is now vice president, midwestern region. At the same time, Airco announced the appointment of **J. P. Casalis, Jr.** as district manager of its St. Louis district.

E. J. O'Rourke has been appointed New York Branch Manager by Philips Electronic Instruments, Mount Vernon, N. Y. He was formerly sales engineer in the New York Office which headquarters in Mount Vernon.

continued on page 32


A tough joining problem on the Boeing 707 landing gear harness was solved by the use of All-State's high strength, low melting, silver bearing #430 stainless solder.
GE obtains ultra-quality welds on the SAGE radar platform through welder training, calibration of equipment, spot checks — and All-State's .040 diameter #4043 aluminum alloy SPOOLARC® wire.
1,000%
1961
100%
1946
All-State
World's largest covered hopper freight car, built of aluminum, is welded with All-State's #5556 SPOOLARC® aluminum wire.

Thank you for your joining problems

...they helped us grow!

In just 15 years ALL-STATE has become a leading manufacturer of more than 100 specialty alloys and fluxes, thanks to the joining problems put to us by distributors, welders and welding engineers. In the solution of these problems we have won your confidence which helped us bring out new problem-solving specialty solders, brazing and welding rods, and fluxes.

In keeping with the rapid expansion of our quality welding alloys, we announce the addition of silicon bronze, deoxidized copper, aluminum bronze and phosphor bronze to the *Spoolarc*® line of automatic welding wire.

The *Spoolarc*® brand leads production of aluminum alloys at ALL-STATE — the largest manufacturer of aluminum welding wire in the U.S.A.

So, as we look ahead to the next 15 years, we repeat our standing invitation: if you have a joining problem — any joining problem with any metals — send us the essential details. We will solve it if we can — and it will not cost you a penny.

Visit our Booth 529 at the Welding Show

ALL-STATE WELDING ALLOYS Co., Inc.

WHITE PLAINS, NEW YORK — QUALITY WITH SERVICE

APRIL IS NATIONAL WELDED PRODUCTS MONTH — VISIT THE A.W.S. WELDING SHOW

Send for free copy of 56-page Instruction Manual

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new

Cylinder Catalog

FREE TO YOU

The new Hackney cylinder catalog is now off the press. It's the most complete data file of its kind on modern cylinders for compressed gases, such as oxygen, nitrogen, argon, carbon dioxide, etc.

The catalog describes and illustrates the wide variety of Hackney quality cylinders. A detailed description of the well-known Hackney manufacturing process, plus special engineering data to help you select the right cylinders, makes this catalog your best ordering guide. Use the coupon below to order your free copy.

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Hackney MILWAUKEE — DOMINION IRON WORKS

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

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Name.....*Title*.....
Firm.....
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City.....*Zone*....*State*.....

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MEN ON THE MOVE

continued from page 30

PROMOTIONS:

Charles D. Evans is manager of manufacturing research for International Harvester Co., Chicago. Mr. Evans is a member of the AWS and is presently a member of the AWS Welding Handbook Committee.

William Vanderhout is assistant general sales manager for the Austin Company, Cleveland, Ohio.

Robert Corey is sales manager of the welding division of Charles W. Kreig, Co., Inc., Newark, N. J., welding supply distributor.

William C. Joerger has been named district manager in the South Niagara Frontier of New York for Eutectic Welding Alloys Corp., Flushing, N. Y.

George R. Postlewait is Western Regional Manager for the RegO Plant Equipment Division of Bastian-Blessing Company. He succeeds **Earl M. Evleth,** retired.

A. O. Smith Corporation recently opened a new Welding Products Division district sales headquarters in Newark, Calif., also the home of the firm's Product Service Division. Manager of the new welding region is **A. R. Schneller,** now responsible for sales out of the Division's western offices.

SCHNELLER

L. E. McIlvain is manager of a new furnace processing plant opened in San Antonio by the Stainless Processing Division of Wall Colmonoy Corp., Detroit.

Wendell H. Cheney is a new field specialist for Norton Company's Abrasive Division, assigned to the Teterboro, New Jersey, district office.

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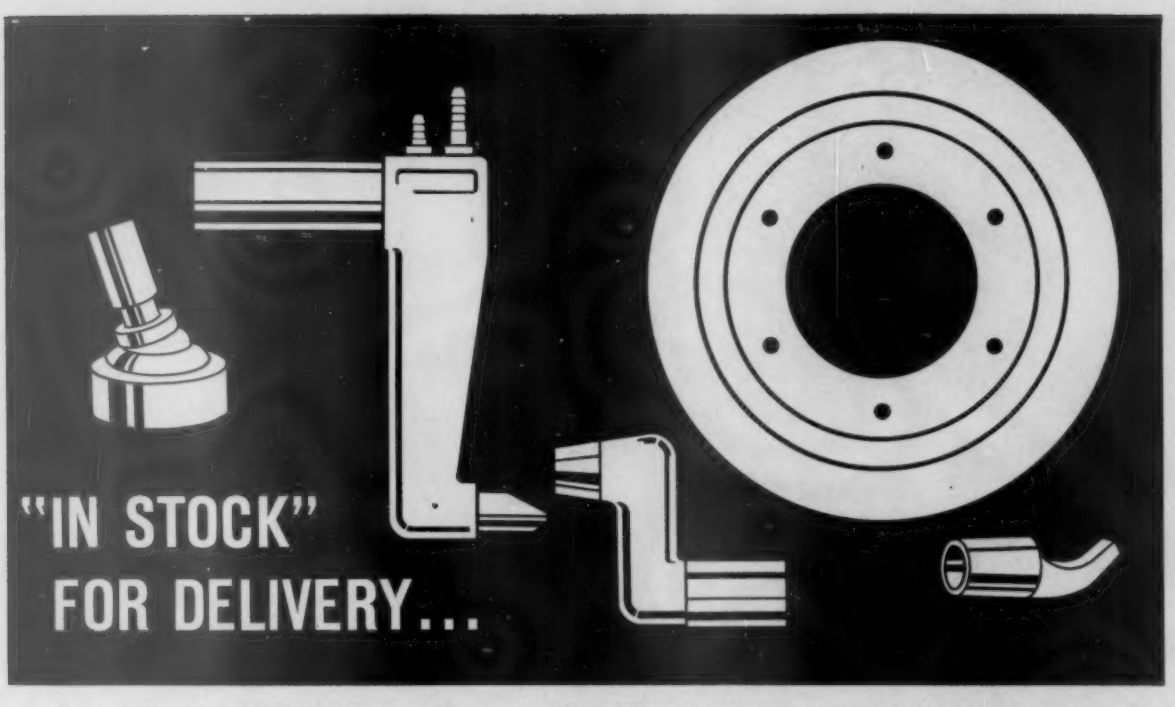

...from distributors everywhere...Mallory resistance welding components

You'll save time and money when you depend on your nearby Mallory distributor for resistance welding supplies. He carries a full stock—ready for immediate delivery—of Mallory *standard components* . . . the most complete line in the industry.

Over 200 Mallory standard electrodes—straight, single bend, double bend, offset and swivel types . . . round, flat, dome and conical tips . . . "special" designs that are standard with us, in availability and price. In Mallory-developed alloys to fit every combination of metals and welding conditions.

Standard Mallory holders—interchangeable components that make over 1000 different setups from a dozen parts; plus a variety of standard holder types.

Mallory seam welding wheels—cold-forged for longest service in heavy duty. Also economy-priced wheels for medium duty.

Mallory Metallurgical Company, Indianapolis 6, Indiana
a division of

P. R. MALLORY & CO. Inc.
MALLORY

Mallory Resistance Welding Products are available from these Authorized Distributors:

Atlanta, Georgia
Pye-Barker Welding Supply Co.
Lee S. Wolfe & Co.
Bell, California
A. P. Seedorff & Co., Inc.
Binghamton, New York
Welders Supply Co.
Birmingham, Alabama
Alloy Rods & Abrasives Co.
Hinkle Supply Co., Inc.
Brooklyn, New York
Collins & Company
Buffalo, New York
Mills Welding Supply, Inc.
Cambridge, Massachusetts
Austin-Hastings Co., Inc.
Charlotte, North Carolina
National Welders Supply Co., Inc.
Chattanooga, Tennessee
Jones Sylar Supply Co., Inc.
Chicago, Illinois
Machinery & Welder Corp.
Stanco Welder & Machinery Co.
Cincinnati, Ohio
G. E. Schmidt, Inc.
Cleveland, Ohio
H. L. McCreery & Son Inc.
Dallas, Texas
Briggs-Weaver Machinery Co.
Engineering Supply Co.
Denver, Colorado
U. S. Welding Works Co., Inc.
Des Moines, Iowa
R & R Welding Supply Co.
Elmira, New York
Welding Service Company
Erie, Pennsylvania
Boyd Welding Co.
Fort Wayne, Indiana
Wayne Welding Supply Co.
Grand Rapids, Michigan
Manufacturers Supply Co.
Hartford, Connecticut
Austin-Hastings Co., Inc.
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Mehl Machinery Inc.
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W. E. Wheaton Co.
Indianapolis, Indiana
Allied Weld Craft Inc.
Welding Equipment & Supply Co.
Jacksonville, Florida
J. B. Wallis Co.
Kansas City, Missouri
Kirk-Wiklund & Company
Kenilworth, New Jersey
The Wheaton Company
LaCrosse, Wisconsin
Randall-Graw Co., Inc.
Los Angeles, California
ABSCO Incorporated
Memphis, Tennessee
Beaver Welding Supply Co.
Milwaukee, Wisconsin
Machinery & Welder Corp.
Minneapolis, Minnesota
Minnesota Steel & Machinery Co.
Moline, Illinois
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New Orleans, Louisiana
Dixie Mill Supply Co., Inc.
Oliver H. Van Horn
Newark, New Jersey
Essex Welding Equipment Co., Inc.
Ogden, Utah
C & C Welding Supply Co.
Oklahoma City, Oklahoma
Hart Industrial Supply Co.
Omaha, Nebraska
Fuchs Machinery & Supply Co.
Oshkosh, Wisconsin
Sommerfeld-Welders Supply Co., Inc.
Phoenix, Arizona
Dye Oxygen Company
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Leonard R. Nourie, Inc.
Weber Welding Supplies
Portland, Oregon
J. E. Haseltine & Co.
Richmond, Virginia
Welders Supply Corp.
Rochester, New York
Welding Supply Corp.
Rock Island, Illinois
R & R Welding Supply Co.
San Diego, California
Dill Industrial
G. S. Parsons Co.
San Francisco, California
Stryco Manufacturing Co.
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Seattle, Washington
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Shreveport, Louisiana
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Skokie, Illinois
Machinery & Welder Corp.
Spokane, Washington
J. E. Haseltine & Co.
St. Louis, Missouri
Hill Equipment Co.
Syracuse, New York
Welding Supply Co., Inc.
Tulsa, Oklahoma
Independent Supply Co.
Marshall Supply & Equipment Co.
Wichita, Kansas
Lampton Welding Supply Co.
Worcester, Massachusetts
Austin-Hastings Co., Inc.

For More Information Circle No. 69 on Reader Service Card.

Looking for a resistance-welding electrode not easily beat by
sustained heat?

Order AMPCO-WELD® for your high-temperature applications.
Send for catalog, price list, and name of your distributor.

AMPCO®

AMPCO METAL, INC., Dept. 177D, MILWAUKEE 1, WISCONSIN
WEST COAST DIV: HUNTINGTON PARK, CALIF.
SOUTHWEST DIV: GARLAND (DALLAS COUNTY), TEXAS
RW-29

For More Information Circle No. 15 on Reader Service Card.

MEN ON THE MOVE

continued from page 32

PROMOTIONS:

Alan Wood Steel Co., Conshohocken, Pa., has promoted three men. **J. Frederic Land** is assistant vice president, marketing, **William T. Hadden** is general manager, steel sales. **George G. Karian** is general manager of a newly formed Iron Powder Division.

Jan Bleeksma is vice president in charge of manufacturing for Amperex Electronic Corp., Hicksville, Long Island, New York.

Cecil Baltzgear has been named supervisor of European marketing for Omark Industries, Inc., Portland, Oregon.

ELECTIONS:

Leonard C. Barr (left) is the new president of Eutectic Welding Alloys Corp., Flushing, N. Y., succeeding **Rene D. Wasserman,** who becomes chairman of the board. Mr. Barr had been executive vice president at Gregory Industries.

M. W. Townsend, vice president of administration of Handy & Harman, New York, has been elected to the newly-created position of executive vice president. In addition to present responsibilities for the Accounting and Treasurer's Departments, he will assume responsibility for the Sales Department. Mr. Townsend joined the company in 1946.

TOWNSEND

continued on page 36

Circle No. 5 on Reader Service Card. ⟶

New Aircospray

DRAMATIC NEW WAY TO HARDFACE . . . RESURFACE . . . BRAZE

New Aircospray is so versatile and inexpensive that it may well be tomorrow's most profitable metal-to-metal surfacing process.

How does it work? Load powdered metal into the hopper assembly of your Aircospray equipment, and (1) Preheat prepared base metal using a gas welding torch with special tip. (2) Spray and fuse the powdered metal onto the preheated base metal. A dry carrying gas, argon, helium, nitrogen, carbon dioxide or compressed air, is used to feed the powdered alloys. In some cases pre-spraying of a thin coat of powdered metal may be necessary to prevent oxidation.

A Big Advantage: Aircospray gives you a controlled supply of powdered metal to the base material. The finished surface is smooth. Post cleaning, grinding or finishing operations are minimized because of Airco's exclusive vibrator dispenser and flowmeter control of gas pressure. *No caking, no turbulence* and *no flashbacks* because the powdered metal does not go through the gas stream. There is minimum powder loss and no stub-end loss, hence substantial savings are assured.

A wide variety of powdered metals and alloys have been applied successfully. These include – Aircolite hardfacing material for severe abrasion and moderate impact on farm implement equipment and Aircolay 6N for medium impact and corrosion and abrasion at elevated temperatures. These alloys are also available with tungsten-carbide for improved wear resistance.

Airco #27 alloy for the brazing of steel, cast iron, brass or bronze provides a bronze braze excellent on tubular furniture (a gas flux must be used).

For complete information on the Aircospray process call your Authorized Airco Distributor. Look in your Classified Telephone Directory under "Welding Equipment and Supplies".

AIRCO

AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated

150 East 42nd Street, New York 17, N. Y.

More than 700 Authorized Airco Distributors Coast to Coast

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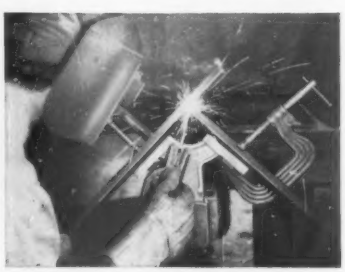
STRIPPIT WORK HOLDERS

1 Save you up to 50% in setup time

STRIPPIT Work Holders and Clamps provide the fastest method for positioning work where volume does not justify the cost of permanent jigs or fixtures. In the shop or on the work site, they can actually save you up to 50% in setup time. In addition, STRIPPIT Work Holders are versatile. You can arrange them in combinations to provide almost any kind of jig-type setup.

2 Position work pieces accurately, positively



STRIPPIT Work Holders are constructed from high strength aluminum alloy with precision machined clamping surfaces for greater accuracy. Strong, light weight aluminum C-clamps with copper plated screws hold the work rigidly to the Work Holders. Aluminum alloy also dissipates heat fast and permanently resists weld spatter.

3 Are perfect for short run welding, brazing, soldering

THE ADJUSTABLE—Two clamping faces adjustable through 180°. Calibrated dial and single quick-locking handle.

THE 90°—Clamping faces permanently fixed for all types of right-angle joining for welding, soldering, brazing.

THE STRAIGHT—Accurately aligned for in-line butt joints. Two holders quickly lock into position for T-joints.

CLAMPS—Quick-acting in 4" and 6", standard in 3". Quick-acting types have trigger for instant setting or release.

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For More Information Circle No. 104 on Reader Service Card.

MEN ON THE MOVE

continued from page 34

APPOINTMENTS:

George Morrison is sales representative in Houston for American Brake Shoe Company's American Manganese Steel Division.

Michael M. Clarke has been added to the field staff of Arcos Corporation's Chicago District office.

Ross S. Peterson has been appointed product sales manager for the Sperry Products Co., division of Howe Sound Company, Danbury, Conn.

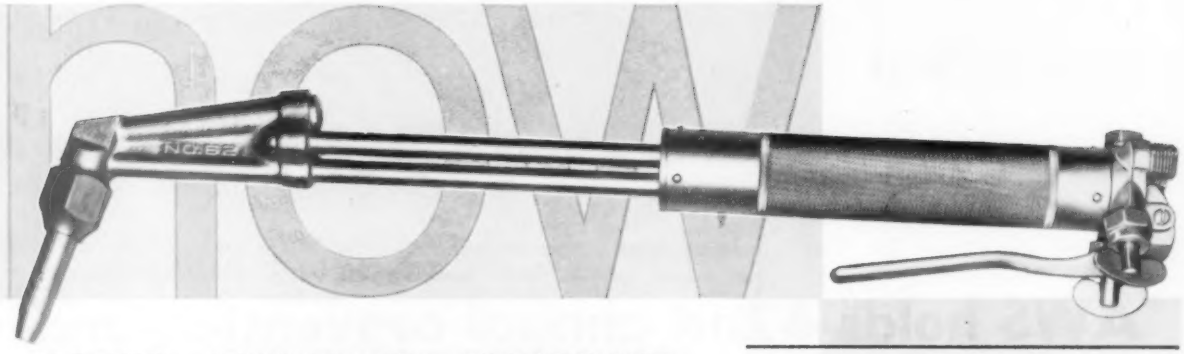
Bill Johnson and **E. C. Sanford** are new sales representatives for Car-Mon Products Co., Chicago. Mr. Johnson will have headquarters in Pittsburgh. Mr. Sanford is with Sanford Mechanical Equipment Co., Oakland, Calif.

AWARDS:

Although awards for 25 years of service are common, rarely does a mother and son receive the award at the same time. Norton Company's Atlanta district manager, Norman R. Ekholm, and his mother, Mrs. Agnes S. Ekholm, did. They were presented their watches and certificates at the company's 40th annual service awards dinner recently. Mrs. Ekholm went to work in Norton's office shortly after the death of her husband, a Norton employee. Norman joined Norton at the same time.

DEATHS:

Pierre Balteau, 41, president of the Balteau Electric Corp., Stamford, Conn., was killed February 15 in the crash of a Sabena airliner near Brussels. Mr. Balteau was returning to his home in Liege, Belgium, following a visit to the United States.



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permits complete coverage for all operations with Harris Model 62-2F torches and tips.

HERE IS WHAT SHOULD INTEREST YOU!

- Total gas costs greatly reduced, yet faster, easier cutting is possible.
- "Automatic" lighting permits immediate flame adjustment.
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- Tips for some unusual applications are illustrated at right.
- All items are Underwriters' Laboratories approved.

COMPLETE CUTTING OUTFIT 62-2F/77'S

62-2F (90° head) or
62-2AF (70° head) Cutting Torch.
77 Gaugeless Oxygen Regulator.
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(or 40N Natural Gas Line Regulator).
Tips as required.

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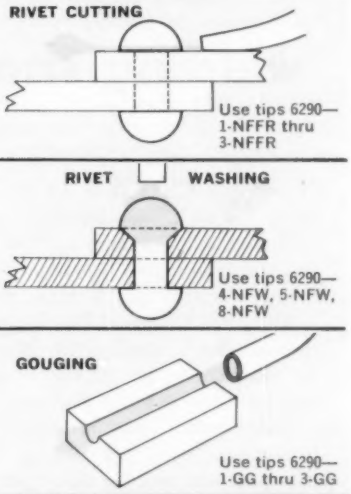

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AWS holds 42nd annual convention and welding show in New York, April 17-21

NEW YORK CITY: Over 18,000 engineers, production men, research, development, and top management personnel will converge on New York City April 17th to participate in the American Welding Society's 42nd Annual Meeting and Welding Show.

The AWS Technical Meeting will be held at the Commodore Hotel, April 17-21. More than 70 papers will be given. See page 22 for a complete list of papers and the time at which they will be given.

The welding Show will be held at the New York Coliseum, April 18-20. More than $3-million worth of equipment will be displayed. Latest developments in processes, equipment, and materials will be introduced. See pages 20-21 for a complete list of exhibitors, a floor plan of the exhibit area.

INTERNATIONAL INSTITUTE OF WELDING

The International Institute of Welding will hold its annual assembly in the United States for the first time. It will be held in the Sheraton-Atlantic Hotel, New York City, April 10-15. Delegations from 28 countries are expected to attend. See page 39 for more details on this organization.

NATIONAL WELDED PRODUCTS MONTH

Governors and mayors all over the country have signed proclamations making April National Welded Products Month. The signing of these documents gives official recognition to the men, methods, and processes which have contributed to the American way of life. The president of the AWS summed up this importance when he said: "The missiles which hurl satellites into space, the submarines which travel under the North Pole and which can launch missiles from the ocean depths, the aircraft which fly at fantastic speeds, and the nuclear reactors which bring power to the underdeveloped areas, rely on one basic process for their existence—welding."

In conjunction with Welding Products Month, displays of welded products will be seen in department store windows, banks, and civic centers all over the country. Automobiles, appliances, and other equipment and products will carry the familiar "welded products" sticker.

MISSILE QUESTIONS ANSWERED

Questions on missile and rocket fabrication will be answered at an open meeting on Wednesday, April 19, at the Commodore Hotel. The symposium-type meeting will be conducted by the AWS Missiles and Rockets Welded Fabrication Committee. Donald B. Howard, American Car and Foundry, ACF Industries, Inc., will be moderator. With him will be the following experts: Francis H. Stevenson, Aerojet-General Corp.; Byron Gates, Budd Company; Donald W. Kinsey, U. S. Steel Corp.; Russell D. Liberti, A. O. Smith Corp.; Joseph W. Jakubowski, General Electric; and John F. Rudy, Armour Research Foundation.

ARRANGEMENTS

The arrangements for the meeting and welding show are a combined effort of the Long Island, New York, and New Jersey AWS Sections. J. E. Dato, assistant manager of welding, Linde Company, is chairman of the arrangements committee. Assisting Mr. Dato are H. D. Landis, Armco International Corp.; John Mikulak, Worthington Corp.; M. J. Giraldi, American Bureau of Shipping; H. C. Cook, Esso Research and Engineering Co.; J. W. Flannery, International Nickel Co.; E. W. Moles, Grumman Aircraft Engineering Corp.; and A. V. Scherer, Air Reduction Sales Co.

More AWS news . . .

See the special insert bound into this issue (pages 20-22) for additional information on the AWS Convention and Welding Show. This insert lists the time and location for all technical sessions. It also presents a floor plan of the New York City Coliseum and shows booth numbers and locations for all exhibitors.

See page 39 for information on the 1961 annual meeting of the International Institute of Welding which is being held in conjunction with the AWS Convention.

A Report on the International Institute of Welding

EDITOR'S NOTE: This report on the International Institute of Welding was prepared by Arham Amirikian, special structures consultant for the Bureau of Yards and Docks, Department of the Navy, and a member of our Editorial Advisory Board. Mr. Amirikian attended that group's meeting in Liege, Belgium, on June 12 through 18, as a U. S. delegate on Commission XV (fundamentals of design and fabrication for welding).

MEMBERSHIP

Each member country is affiliated with the Institute through an official sponsoring agency. In the case of the United States, affiliation is through a council composed of representatives from the Welding Research Council, the American Welding Society, and the Ship Structures Committee of the National Research Council. This council in turn appoints the American representative to the Institute.

COMMISSIONS

The technical activities of the Institute are carried out through its 15 commissions. These working committees meet annually to plan, discuss, and review the tasks assigned to them. Each member nation appoints one delegate (who votes) and a desired number of experts and observers to each commission.

These are the 15 commissions: I, gas welding and allied processes; II, arc welding; III, resistance welding; IV, documentation; V, testing, measurements, and control of welds; VI, terminology; VII, standardization; VIII, hygiene and safety; IX, behavior of metals subjected to welding; X, residual stresses and stress relieving; XI, pressure vessels, boilers, and pipelines; XII, special arc welding processes; XIII, fatigue testing; XIV, welding instruction; XV, fundamentals of design and fabrication for welding.

ANNUAL ASSEMBLY

The Institute convenes annually in a city of one of its member countries. To date, the 12 annual conventions have been held in Europe; the last took place in Opatija, Yugoslavia.

The assemblies are arranged primarily for the transactions of the commissions. They meet mornings and afternoons in continuous sessions that last three to four hours. These daily sessions are devoted to the detailed discussion of the reports prepared by the various sub-commissions and task groups.

A great number of reports originate in each commission. For example, in Commission XV alone, over 110 reports have been submitted to date and considered for the needed action. Reports approved by the commissions are submitted for publication as Institute documents.

A series of open lectures are given during the assembly week. This year's theme was the welding of very thick materials, including steel and aluminum.

Editor Visits Germany

Charles Berka, editor of WELDING DESIGN & FABRICATION, is one of a group of leading American editors and newsmen who will visit major German industrial installations this month. He will spend a week studying welding techniques at Volkswagen plants in Wolfsburg and Hanover. Watch for a complete report in an early issue.

THE LARGEST COMMERCIAL vacuum processing furnace in this country is now in operation at Aerobraze Corporation, Wickliffe, Ohio, a suburb of Cleveland. Maximum operating temperature of the new furnace is 2600°F. Lowest vacuum obtainable is 0.1 micron. Maximum part size that can be processed is 36-inches in diameter and 48-inches. Smaller parts are treated in batches, stacking a number of trays, one on top of the other.

Welding Course For School Teachers

TROY, OHIO: The Hobart Welding School is holding its third annual one-week summer welding refresher course. It's for industrial arts teachers who want to brush up on their welding techniques. The course will be held on the second and fourth weeks of June, July, and August. Fee is $20.00.

Full details are available from Hobart Brothers Technical School, Troy, Ohio.

more news on page 122

NEW SUPER-TOUGH ORE HAULER USES

N-A-XTRA

HIGH-STRENGTH STEEL

TO CUT DEAD WEIGHT AND STRETCH PAYLOAD CAPACITY

This Lectra Haul M-55, made by Unit Rig and Equipment Co. of Tulsa, is now working in the open pit iron mines in Minnesota's Mesabi range. In bone-freezing —40° weather, it can stand up to the shuddering shock of 55 tons of drop-loaded iron ore, climb a 6% grade at 8.6 mph then dump those 55 tons in a crashing, grinding 18 seconds. The quarry body that takes this loading impact and dumping abrasion in sub-zero temperatures is made of N-A-XTRA high-strength steel, with X-A-R Abrasion Resistant Steel for extra hardness and toughness in wear areas. N-A-XTRA also forms the structural members of the complete unit.

Why N-A-XTRA? Because, pound for pound, it's nearly three times stronger than ordinary steel. That means it's strong enough to absorb severe punishment without constant maintenance, and light enough to handle the highest possible payload. In fact, the Lectra Haul payload is almost as much as the net vehicle weight itself.

N-A-XTRA and X-A-R are doing the job where only the strongest steels will do. Easily formed and welded, they are making products stronger, lighter, longer lasting. N-A-XTRA fully quenched and tempered steel is available in four levels of minimum yield strengths, from 80,000 to 110,000 psi. X-A-R steels are supplied in hardnesses from 360 to 400 BHN (or, by agreement, in a range between 265 and 500 Brinell). For full technical information, write Great Lakes Steel Corporation, Product Development, Dept. WDF-1, P.O. Box 7310, Detroit 2, Michigan.

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N-A-XTRA AND X-A-R STEELS ARE AVAILABLE AT THESE STEEL SERVICE CENTERS

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O'Neal Steel, Inc. Birmingham, Alabama	Salt Lake Hardware Co. Salt Lake City, Utah	A. C. Leslie & Company, Ltd. Montreal, Canada

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Lectra Haul M-55; made by
Unit Rig and Equipment Co., Tulsa, Okla.
224,000 lbs. GVW
110,000 lbs. capacity
700-hp. diesel engine
4 wheel-mounted electric traction motors

Steel

Look for the STEELMARK on the products you buy; place it on the products you sell.

Design note: Bottom, sides and front of the Lectra Haul quarry body were fabricated of N-A-XTRA 100 (100,000 psi minimum yield strength) from plates ½" thick and reinforced with cold-formed channels of ¾" thick N-A-XTRA 100. Wear areas of bottom, side and front slopes were made of X-A-R Abrasion Resistant Steel from plates ⅝" thick, 388 Brinell hardness. Fabrication followed standard shearing, gas cutting and welding procedures.

Great Lakes Steel is a Division of **NATIONAL STEEL CORPORATION**

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WELDING AT WORK

to do the job better and cheaper

Welded aluminum fire truck guards missile installations

RIDGEWOOD, N. Y.: A light, rugged, fire-fighting aluminum vehicle is now protecting Army missile installations. The Class 1500 fire truck is made here by the Walter Motor Truck Co.

Abbott Manufacturing, Inc., West Norwood, N. J., produced many components for the truck, utilizing Linde Company's TIG and MIG welding equipment to weld aluminum foam-tanks, truck tops and sides.

Each foam-tank is 7-feet long, 5-feet wide, and 5-feet deep. The outer seam was welded with a Heliarc HW-10 torch. No pre-weld preparation or post-weld finishing was needed. Rectangular-shaped funnels for filling the tanks were fabricated from pre-cut sections of 6061 aluminum sheet, ⅛-inch thick. Each funnel was tack- and corner-welded with Linde's new spool-on-gun Sigmette torch. On both the truck tops and side panels, a Sigma SWM-2 welding machine was used to join 14-gage sheet to ⅛-inch channel.

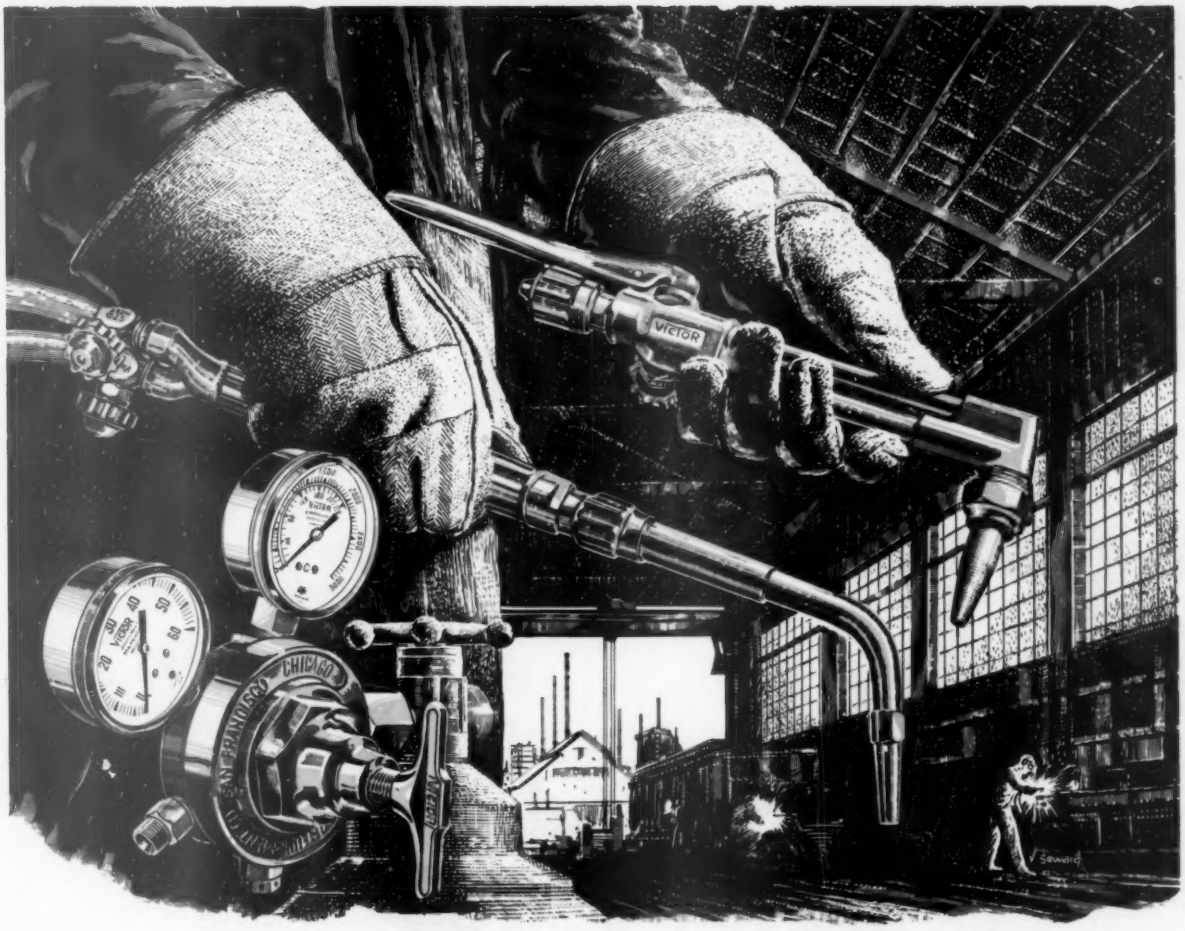
Abbott used Linde's constricted arc cutting process to make 1-inch-thick, 12-inch-diameter reinforcing rings for hose connections. A FSH-6 cutting torch mounted on a rotating fixture cut two rings per minute. Good kerfs required little finishing.

Composite design cuts cost of highway overpass

MOORESTOWN, N. J.: Stud welded shear connectors enabled the Pennsylvania Department of Highways to reduce the cost of the Route 13 overpass on the Delaware Expressway.

Shear connectors stud welded to the top flange of huge plate girders allowed the use of light steel sections with a resulting saving in steel fabrication and sub-structure costs. The use of such devices, known as composite design, also reduces the overall height of the bridge and approaches, resulting in savings in right-of-way and fill costs.

The 140-feet-long, 20-ton steel girders for this project were fabricated and erected by American Bridge Division of United States Steel Corp. Stud shear connectors were furnished by KSM Products. *Editor's Note: See page 59 of this issue for a complete article on this subject, entitled: "Stud welded shear connectors: The key to construction strength."*



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Combination Welding and Cutting Units

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See your Victor dealer's complete stock of welding and cutting units for industrial uses . . . or if you're looking for economy, Victor's Super-Range unit (only $99.00, including accessories) is your best buy. Helpful literature yours for the asking. Call your Victor dealer today.

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WELDING SHOW — NEW YORK COLISEUM — APRIL 18-20

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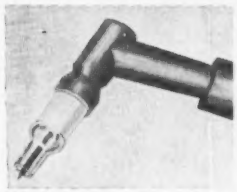
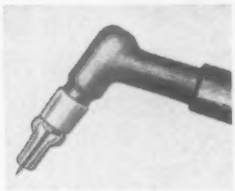
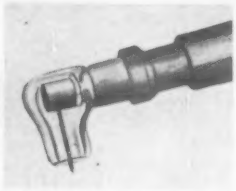


TEC Watercooled Angle Torch

TEC Watercooled Pencil Torch



TEC Aircooled Torch



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IMPORTANT NEWS!
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Products will be introduced at the
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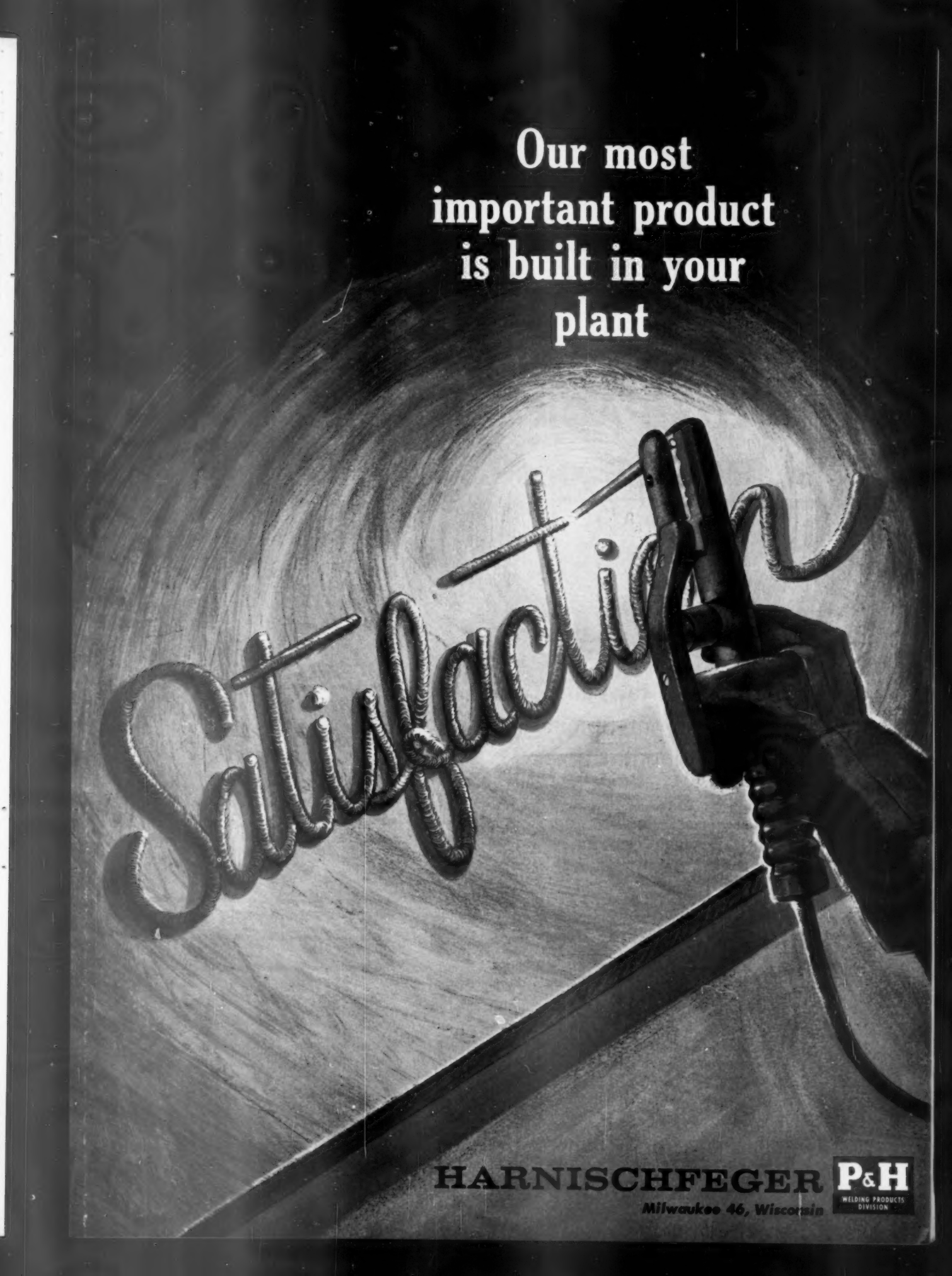
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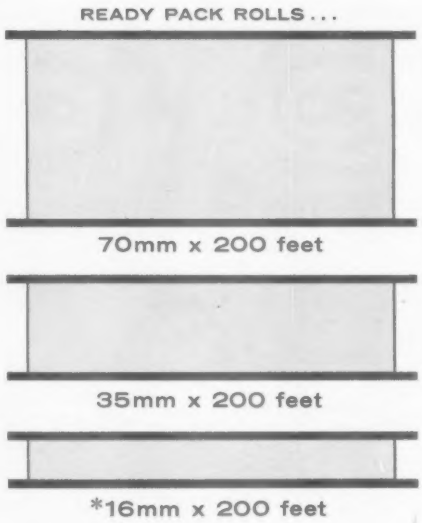

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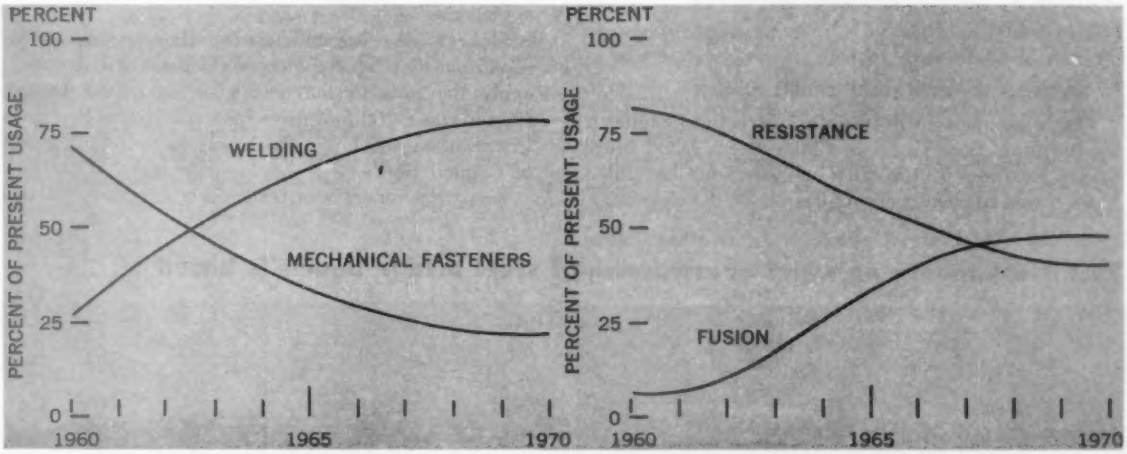
APRIL, 1961 Welding Design & Fabrication

Welding will replace mechanical fasteners in the Aerospace industries



COMPLETE REVERSAL in percentage use of welding and mechanical fasteners will take place by 1970.

FABRICATION of lightweight fuel-tight structures will cause this big swing to fusion welding.

IN BRIEF: Here are the facts brought out by a 10-year forecast of trends and requirements just released by the Aerospace Industries Association. Opinions of member companies were taken and averaged out.

WELDING WILL just about replace mechanical fasteners by 1970. That's the prediction of the Aerospace Industries Association. The Association says there will be advances in mechanical fastening, but these will not be enough. Instead, the trend toward welding, particularly automatic, will continue, following the need for making strong joints in high-strength high-temperature metals that are thermally treated to more than 350,000 psi.

This prediction will come true only after these advances are made in fixturing and positioning:

- Clamping fixtures and positioners that permit uniform speeds when welding 0.005- to 0.020-inch-thick sheet.
- Lightweight holding devices for ultrasonic welding.
- New fixture materials for chilling, clamping, and locating sheets during butt welding. These may be made from improved ceramic materials.
- Fixtures and dies for explosive welding to permit sizing of parts during welding, but without warping.

OTHER WELDING NEEDS AND TRENDS

- Fabricating lightweight, fuel-tight structures will put more emphasis on fusion welding, less on resistance welding.
- Ultrasonic welding will have to be improved. For joining honeycomb panels, ultrasonic welding might be adapted, with the welding medium being powder or granular, and attracted to the weld joints magnetically to allow welding at a low temperature. Equipment is also needed to produce consistent weld quality in materials like titanium and PH steels from 0.005- to 0.125-inches.
- Welding without heat will be called for. One method might be to use metallic compounds placed in the joints, with fastening being done by a chemical reaction triggered by gas.
- Techniques and equipment must be developed for welding refractory metals to dissimilar metals and for welding metals to glass.

continued on page 89

A WELDING SHOW FEATURE REPORT

Prestressed steel beams replace concrete

IN BRIEF: Here's how one State applied the principles of prestressing to steel bridge beams and used them in a 200- by 30-foot continuous prestressed I-beam bridge.

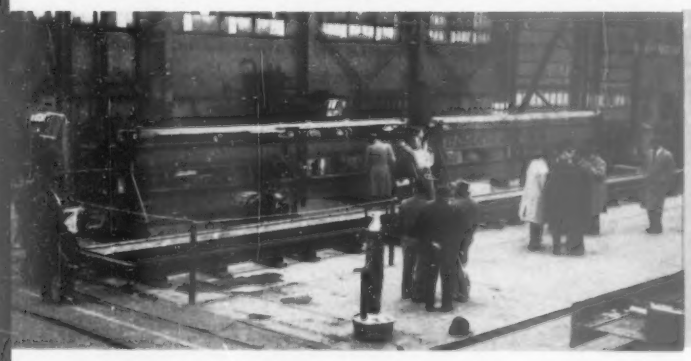
"WHY NOT PRESTRESS STEEL BRIDGE BEAMS?"

That's the question Bill Barnard, structural engineer for the Iowa State Highway Commission, asked Iowa Bridge Engineer Neil Welden one afternoon last July. Welden was tremendously impressed by the simplicity and practicality of Barnard's ideas (see illustrations and copy at the bottom of the page). So, he and Barnard showed them to Don McLean, the design engineer.

McLean also was enthusiastic. He told them to go ahead and develop the idea. Welden asked Barnard to apply the idea to the design of an actual bridge. Chosen was a 200-foot three-span continuous bridge in Pottawattamie County, which was to be rebuilt north of Council Bluffs.

Barnard's report was ready in a few days. It was

This is the theory on which prestressing of steel bridge beams is based . . .



TESTS ARE MADE on prestressed steel beams.

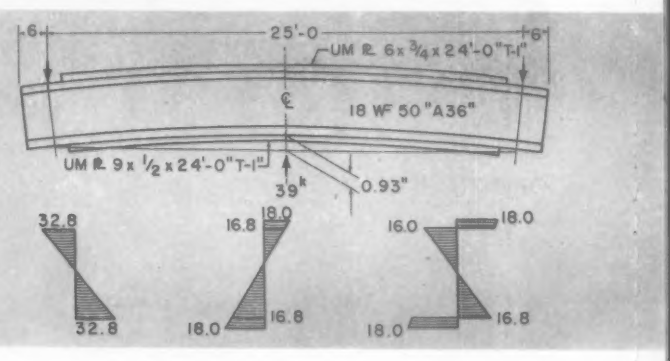


FIGURE 1: Pier beam.

Figure 1 shows the procedure for prestressing a beam in composite action with the slab—a simple span beam, or the end and interior span beams of a continuous structure. This beam is an experimental one, but it shows the procedure.

1. Applying a downward load of 29,000 lb. at the center of the beam. This produces a compressive stress of 32,800 psi in the top flange, an equal tensile stress in the bottom flange, and a deflection of 0.93 inch. The beam is A-36 steel with a yield point of 36,000 psi and a working stress of 20,000 psi.

2. Placing a plate of high strength steel (T-1) on the top flange. This plate is a heat treated weldable steel with a 100,000 psi yield strength and a 55,000 psi working stress. This unstressed plate is then welded to the beam in its unstressed condition.

3. Removing the load. The effect is the same as loading a cover plated beam in the opposite direction, because the plate is now welded to the beam, and acts with it. Stresses caused by removing this load are shown in the center diagram: maximum tension of 24,700 psi in the cover plate, 23,600 psi tension in the top flange of the beam, and 31,000 psi compression in the bottom flange.

The resultant stresses are the algebraic sums of the stresses due to loading and those due to the removal of the load. These are shown in the diagram at the right: 24,700 psi tension in the cover plate, 9,200 psi compression in the top flange, and 1,800 psi tension in the bottom flange.

In a structure, the beam is inverted and a concrete slab is placed on what is now the top flange. It is attached with shear lugs to insure composite action. Then, under load, the beam acts as a composite cover plated beam, utilizing the restrained stresses. The cover plate takes additional tension. Since the allowable stress in T-1 steel is 55,000 psi, it can do so, up to an additional 30,300 psi. In the bottom flange, the load first reduces the compressive stress to zero, and then puts the flange in tension up to 20,000 psi, the allowable stress for A36 steel. This gives a total available effective tension of 20,000 plus 9,200 or 29,200 psi. Similarly, in the top flange, the existing tensile stress is reduced to zero and the flange then goes into compression. The stress in this flange is limited by the allowable compression in the adjacent concrete. It remains low since the neutral axis of the composite section is well above the center of the beam.

Figure 2 shows the procedure for a beam not in composite action. It is Iowa's practice to use beams of this type over the interior supports of a continuous beam bridge, where the concrete is in tension, and is felt to be not very effective in com-

neat, economical, and complete. It contained a statement of principles, noted the inherent advantages of steel as a prestressed material (its ability to resist both tension and compression) and the inherent disadvantage (the flexibility of the shallow members used to save weight). His report contained a design sketch of the proposed 200-foot three-span continuous bridge (see page 50).

The cross section is Iowa's normal 30-foot roadway layout, with 2-foot safety curbs. The beam layout shows 24-inch-wide flange, 76# exterior beams and 27-inch-wire flange 94# interior beams. Normal design calls for 33-inch exterior beams and 36-inch interior beams. The stressing procedure for the interior beam in the interior span is shown at left. The beam is loaded at the center line with a 57,000 lb. load, which causes a deflection of 1.65 inches, and a stress of 30,000 psi in each flange. An 8- by ½-inch T-1 plate is placed on each compression flange and welded in place. The load is then removed. The resulting stresses are:

2,000 psi tension in the top flange
8,600 psi compression in the bottom flange
22,400 psi tension in the cover plate

Text continues on page 50

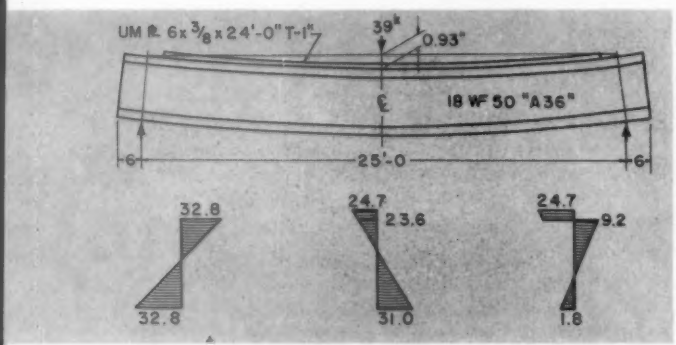


FIGURE 2: Positive moment beam.

posite action. This, again, is an experimental beam of A-36 and T-1 steel. The procedure is as follows:

1. A load of 29,000 lb. is applied at the center line of the bare beam. This causes a deflection of 0.93 inch and induces a stress of 32,800 psi in each flange, as before.

2. A T-1 plate is placed on each flange. These plates are unstressed and are welded to the flanges in that condition.

3. The load is released, causing the stresses shown in the second diagram.

The resultant stresses are shown in the third diagram: 18,000 psi compression in the top plate, 16,000 psi tension in the top flange, 16,000 psi compression in the bottom flange, and 18,000 psi tension in the bottom plate.

In the structure, the beam is again inverted since, in a pier beam, the structural stress is tension in the top flange and compression in the bottom flange. These structural stresses are symmetrical, since no composite action with the slab is involved. To resist structural loading we have available:

In the plates: 55,000 minus 18,000 = 37,000 psi, tension in the top plate, compression in the bottom.

In the flanges: 16,000 plus 20,000 = 36,000 psi, tension in the top flange, compression in the bottom.

Principles of prestressing . . .

First, we induce in a structural member a stress opposite to that it will resist in the structure. For instance, we induce compression in that part of a concrete beam which will be in tension under structural loads.

Then we restrain that stress. In a pretensioned, prestressed concrete beam we put steel tendons in high tension and place concrete around them. When the concrete is set, we release the tendons which, by shortening, induce compression in the concrete. This compression is restrained by bond between the concrete and the steel.

Finally, we place the member in a structure, using the restrained stress to resist the stress caused by structural loads. Concrete is weak in tension, but strong in compression, and by prestressing it in compression, we can resist the stress due to structural loads by simply reducing the compression and avoid any resultant tension in the concrete.

Because it is weak in tension and strong in compression, concrete is an excellent material for applying the prestressing principle. That's why prestressing was applied first to concrete in the 1920's. However, mild steel rods were used to apply the prestress. The resulting compression in the concrete was eliminated by plastic flow. In the 1930's, Freyssinet, a French engineer, conceived the idea of using high strength concrete, and prestressing it with high strength steel rod. That way plastic flow would reduce the compression in the concrete only slightly. This idea proved sound and several structures were built.

After the war, France, Belgium, and Germany used prestressed concrete to replace war-destroyed structures. They developed procedures and principles rapidly.

In 1950 the first prestressed concrete bridge in the United States was built in Philadelphia. The use of prestressed concrete spread very quickly. In 1954 the Iowa Highway Commission designed and published standard prestressed concrete brige plans for secondary roads. In 1956 and 1957 Iowa began to use prestressed concrete bridges on primary roads and Interstate Highways. They proved cheaper than steel for short spans with little or no skew. Iowa now uses them almost exclusively for that type of bridge.

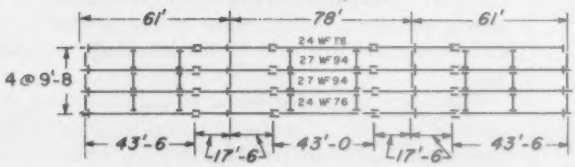
The success of prestressed concrete led to experiments with prestressing steel structure. This used to involve the use of high strength steel rods to induce compression in the lower flange of girders, or the bottom chord of trusses. It has generally been considered economical only for long spans, 150 to 175 feet or more.

Once Iowa considered strengthening a Cass County deck truss in this manner, to enable it to carry a wider roadway and heavier live load. It abandoned the project when it proved more satisfactory to replace the bridge. Bill Barnard, Iowa structural engineer, has recently made some calculations for simple span prestressed steel beam bridges of this type. These may prove economical for spans as short as 60 to 70 feet.

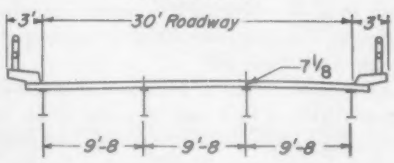
200′ x 30′ CONTINUOUS PRESTRESSED I-BEAM BRIDGE

Iowa State Highway Commission

Beam Layout

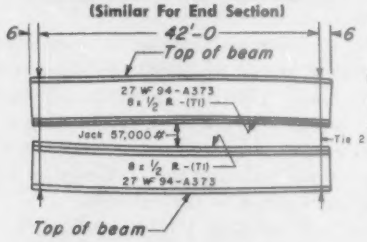


Cross Section



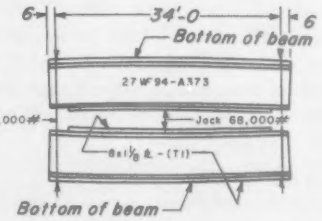
Stressing Procedure Int. Beam

Center Section Int. Beam
(Similar For End Section)

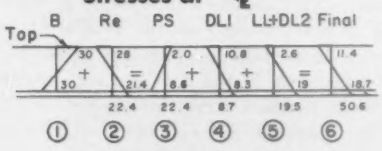


Plates are not welded until jacking is done

Pier Section Int. Beam



Stresses at ℄



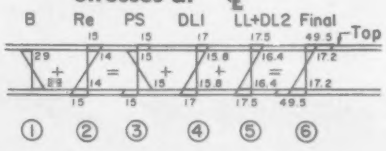
Initial deflection	1.65"
Recovery on release	1.37
Final camber	.28"

* Stresses as shown are in k.s.i.

Compression to left.

Tension to right.

Stresses at ℄



Initial deflection	1.00"
Recovery on release	.49
Final camber	.51"

Dead Load 1 (the weight of the structural steel and the concrete slab, which is not resisted by composite action) adds:

10,800 psi compression in the top flange
8,300 psi tension in the bottom flange
8,700 psi tension in the cover plate

Dead Load 2 (the weight of the curb and future wearing surface)—live load and impact, all resisted by composite action add:

2,600 psi compression in the top flange
19,000 psi tension in the bottom flange
19,500 psi tension in the cover plate

The final result is the algebraic sum of these stresses:

11,400 psi compression in the top flange
18,700 psi tension in the bottom flange
50,600 psi tension in the cover plate

At right is the stressing procedure for the interior beam over the pier. This beam is symmetrical, since composite action is not considered. Placing a 68,000 lb. load at the center line causes a stress of 29,000 psi in each flange. Then a 8- by 18-inch T-1 plate is placed on each flange, welded in place, and the load removed. The resulting stresses are:

15,000 psi tension in the top plate
15,000 psi compression in the top flange
15,000 psi tension in the bottom flange
15,000 psi compression in the bottom plate

Dead Load 1 adds:

17,000 psi tension in the top plate
15,800 psi tension in the top flange
15,800 psi compression in the bottom flange
17,000 psi compression in the bottom plate

Dead Load 2, live load and impact adds:

17,500 psi tension in the top plate
16,400 psi tension in the top flange
16,400 psi compression in the bottom flange
17,500 psi compression in the bottom plate

The total maximum stress is the algebraic sum of these stresses. It amounts to:

49,500 psi tension in the top plate
17,200 psi tension in the top flange
17,200 psi compression in the bottom flange
49,500 psi tension in the bottom plate.

WHAT WAS ACCOMPLISHED?

Prestressing enables a relatively light, shallow beam to replace a heavier, deeper beam. In this case it saves

about 55,000 lb. of steel, or nearly 25 percent. Some relatively expensive T-1 steel has been used and has probably increased the cost of fabrication. However, it is believed this procedure will result in a net saving in the cost of bridges. This savings will increase as fabricators become more familiar with the processes.

STEEL PRODUCERS AND FABRICATORS PITCH IN

At this Welden and Barnard met with a group of steel producers, fabricators, and AISC representatives. They distributed copies of Mr. Barnard's report which was discussed. Welden and Barnard were encouraged to go ahead with the development.

However, the bridge originally selected was not programmed for letting in the near future. So, Welden and Barnard chose a bridge over Silver Creek in Pottawattamie County, on Highway 6, which was scheduled for immediate replacement. This was a 240-foot three-span bridge and less satisfactory for their purpose than the bridge they had first chosen. Ordinarily, a welded girder bridge is used for a span of this length. Such a bridge contains less steel than a rolled beam bridge, so the weight savings would be less. Moreover, a prestressed steel bridge of this length would be quite flexible. However, a quick check of live load deflection showed it was well within the allowable limit. They decided to go ahead.

They also decided to fabricate a prototype beam, which Barnard designed. Then they called a meeting of steel manufacturers and fabricators. U.S. Steel offered to furnish the required T-1 plates; Bethlehem Steel and Inland Steel each offered to furnish one of the required beams. Local fabricators offered to pay for the fabrication. The prototype beams are shown on pages 48 and 49.

Bernard and Stephen Roberts, research engineer for the Highway Commission, laid out instrumentation for the prototype beams. They hoped this would allow them to determine the stresses at various locations, and assure that the beam stresses actually conformed to the theory. The Pittsburgh-Des Moines Steel Company offered to fabricate the beams, and the Des Moines Steel Company, the Clinton Bridge Division of Allied Structural Steel Company, the Missouri Valley Steel Company, and U. S. Steel's American Bridge Division shared the cost.

Material for the prototype beam was received in October. The Materials & Test Department of the Highway Commission prepared the beams for prestressing and applied the instrumentation. James Johnson was in charge.

FIRST TESTS SHOWED PROBLEMS

The beams were prestressed and fabricated early in November. The loads were removed the next day. The results were disappointing. When the loads were applied, the beams tended to deflect laterally, as well as vertically. The load was reduced to 30,000 lb. instead of the calculated load of 39,000 lb. At this loading the hydraulic jack, which had been used to load the beam, was replaced by screw jacks, since, in order to simplify the fabrication, it was decided to hold the deflection rather than to attempt to keep a uniform load. The cover plates were then welded in place, using automatic welding for the beam with two cover plates, and semi-automatic welding for the beam with one cover plate. When the weld had cooled, the hydraulic jack was used to release the screw jacks. In the beam with two cover plates, distortion due to welding had reduced the load from 30,000 lb. to 24,000 lb. In the beam with the single cover plate, welding distortion had reduced the load from 30,000 lb. to 16,000 lb.

Welden went home that evening feeling very discouraged. He spent the week-end trying to find a way out.

On Monday morning, Barnard suggested that, instead of fully welding the cover plates while the beam was deflected, they be tack welded to the beam just enough to transfer stress to the plates. This amount of welding would cause very little distortion. And, after tack welding, the load could be released and welding completed with the beam free to deflect. This seemed to be the solution, so it was tried.

Fortunately, the manufacturers had furnished an extra set of beams and plates. It was decided to fabricate the beams in the laboratory at the Highway Commission. Pittsburgh-Des Moines Steel Company furnished equipment and personnel.

The experience with the first pair of beams showed certain setup changes were advisable. Instrumentation was changed to use Whittemore gages to a greater extent, since SR-4 gages in some locations were destroyed by the heat of welding. A yoke was used to prevent lateral deflection and temporary stiffeners were placed at reaction points.

The beam with the single cover plate was stressed first. No difficulty in applying the calculated load. Tack welding the cover plate caused very little distortion. The load was released and strain gage readings indicated that the results agreed satisfactorily with the calculated stresses. The weld was completed and the beam was tested under load. The results were excellent.

A similar procedure was used on the beam with two cover plates. Again the results were satisfactory. They were so encouraging we decided to proceed with the plans for the full-sized bridge. These are now complete. The bridge was let in February.

CREDIT WHERE CREDIT IS DUE

This whole idea was conceived by Bill Barnard (left, foreground). He resolved difficulties which arose and is entitled to all the credit which may accrue. The experimental work would have been more difficult if it had not been for the willing and competent assistance of Neil Welden (left, background), James Johnson, John Roland, Lyman Moothart, Harold Sharpneck, and others from the Materials and Test Department of the Highway Commission. Stephen Roberts had charge of the experimental work and made valuable contributions. • •

A WELDING SHOW FEATURE REPORT

Flame cutting tracers: guides to good cutting

IN BRIEF: Here's a survey of up-to-date flame cutting tracing devices, including the latest electric eyes. The tracers are classified. So are the machines on which they are used.

FLAME CUTTING has gone places—because it was led there by tracers. Tracers have put flame cutters into the machine tool class; in fact, parts can be cut so accurately, machining is often unnecessary. Tracers have made possible high-speed, accurate, and economical parts in any shape, over many contours, and in large quantities. The manufacturers of flame-cutting equipment feel strongly about tracers. One puts it this way: "The greatest change will come in improvement of tracing methods."

And, of course, with improvements in tracing, there'll be continued improvements and developments in the flamecutting machines. One goes with the other. Machines get larger, go faster, farther, are simpler, easier to maintain, and easier to operate.

The first tracing device was a soapstone line on the plate. The controls were the operator's eyes, arms, and his firm grip on the torch. The cuts were approximations (and still are); fine for short, low-quality work, but lacking in speed, quality, and accuracy. So the flame cutting people took the torch from the operator, clamped it to a machine guided by a tracer.

One of the first flame cutting machines that was tracer led was the portable—a motorized carriage that follows a track or cuts circles anywhere along a radius rod. Portables are still very popular because they are cheap and because they can put out a lot of accurate work anywhere. And these truly automatic midgets have had their share of progress too: synchronized electrical and clutch controls; constant speeds (in a wide range) up hill and down; floating torch assemblies that cut square, no matter what the contour of the plate.

On the much larger, stationary machines, the manufacturers have added torches so that eight or ten identical parts are cut for the price of one.

WELDING DESIGN & FABRICATION had these purposes in surveying equipment manufacturers for this report: To bring you up to date with tracing science; to show you what machines the tracers are used on; and to help dispel the confusion regarding generic and trade names of flamecutting machines.

MANUAL TRACERS

Manual tracers are generally motor-driven but steered by hand. A drive wheel contacts the template table and regulates the speed of cutting. On some makes, the operator steers the wheel along the lines of a full-size drawing or blueprint. The torch cuts the same pattern because a linkage transmits the motion from tracer to torch. Other manual machines have a pointer, or project crosshairs or crosslights on the lines of the drawing. One unit, without a drive, freewheels over the drawing.

Tracers with drive wheels are built to move and turn easy and steady so that intricate parts can be cut without spurts or lags. Driven tracers have variable speed so that the machines can cut different thicknesses.

Some of the knurled-wheel drive machines make straight or circular cuts without guidance.

Spindle tracers are another manually guided tracer. They are used where extremely accurate cuts are not necessary. The tracing head follows a 2-dimension template of plywood, metal, or hard board. The operator holds the turning spindle against the template to provide traction to move the torch.

AUTOMATIC TRACERS

Automatic tracers shift the responsibility for accurately flame cut parts from the operator to the tem-

continued on page 54

USE THESE FLAME CUTTING TRACERS . . .

NOTE: Letters and numerals indicate the machine on which the tracer is used. See machine table below.	MANUAL			AUTOMATIC							
								Electric Eye			
								No Drive on Template			
COMPANY	Motorized Drive (follows drawing with wheel, pointer, or light)	Motorized Spindle (held against template)	Manual Pointer (follows drawing)	Knurled Grip (strip tracer)	Magnetic	Edge (black to white contrast)	Line (white to white—scans pen, pencil, or photo negative line)	Electronic—Coordinate Drive	Mechanical—Roller Drive	Ratio Controls	Tape Controls
Air Reduction Sales Co.	A,B,D	A,B,C,D			A,B,C,D	A,B,D	A,B,D				
Earth Equipment Corp.	C										
Heath Engineering Co.	C										
Linde Co., Div. of Union Carbide Corp.				A,B, D(1),D(2)	A,B,D(1), D(2)	D(5)	All, Neg.-D(5)	D(4)	D(3)	D(5)	
Messer Cutting Machines, Inc.	D(1),D(2)	D(1),D(2)	D(1),D(2)	D(1),D(2)		D(2),D(3) D(4)	D1:10(4)	D(3),D(4)	D(2)	D1:10(4)	D1:10(4)
National Cylinder Gas Div. of Chemetron Corp.	D(1),D(2)	D(1),D(2)	D(1),D(2)	D(1),D(2)			D(1)				
Ohmstede Machine Works		C			C						
Victor Equipment Co.		C									
Westinghouse Electric Co.											

. . . ON THESE MACHINES

NOTE: These letters, and the preceding numbers, show (in above table) the machine on which the tracer is used. ►	A	B	C	D	E	F	
	PANTOGRAPH			TRANSVERSE CARRIAGE	PORTABLE	BAR CUTTING	
COMPANY	Traveling Carriage	Fixed Base	Tracer Over torch		(Motorized carriage; track or radius rod)	Portable	Stationary (hot or cold)
Air Reduction Sales Co.	Linagraph	Travograph	Camograph	Duograph, Monograph	Radiograph		
Burdett Oxygen Co.					Burdox Beaver		
Earth Equipment Corp.			Gloor Expeditor				
Heath Engineering Co.			Ultra-Graph				
Indiana Oxygen Co.					Cut-a-Line		
Linde Co., Div. of Union Carbide Corp.	Oxweld CM-15	Oxweld CM-15		(1) Oxweld CM-41 (2) CM-23, (3) CM-56, (4) CM-60, (5) CM-70	(1) Oxweld CM-45, (2) CM-30, (3) CM-37, (4) CM-75, (5) CM-16	Oxweld CM-35	Oxweld CM-57
Messer Cutting Machines, Inc.				(1) Corta, (2) Statosec, (3) Sicosec, (4) Sicomat	Quicky		Bloom & Billet
National Cylinder Gas Div. of Chemetron Corp.				(1) Type R, (2) Type JR	Cut-O-Matic Beetle		Billet Cutoff
Ohmstede Machine Works			OMW				
Oxo Welding Equipment Co.					Oxomatic		
Steffan Machine Corp.					Mechanized Hand Cutter		
Ty-Sa-Man Machine Co., Inc.				Flame Saw			
Victor Equipment Co.			Duplicutter		Model VU-120		
Weldit, Inc.					C-2		

FLAME CUTTING TRACERS

continued from page 52

plate designer and maker. These tracers do all of the guiding, freeing the operator to concentrate on the cut. Automatic tracers are capable of giving you the highest production, the greatest accuracy, and the most versatility—cut after cut.

Strip tracers were one of the first automatic tracers. They grip a metal strip (sometimes knurled) between rollers. This gives traction to the drive roller so that it follows the contour of the template strip. The templates are easily made by tack welding strips to a piece of thin plate.

Magnetic tracers. Magnetism holds a turning roller against the face of a steel template while it follows a strip-type or light-gage template. Most magnetic tracers have lateral and vertical adjustment to simplify setup. Cutting speeds depend on the motor and on the diameter of the magnetized roller. Some machines have direct-reading tachometers which show travel speed in ipm. Some tracing machines are used for welding as well as for flame cutting. Many users like magnetic tracers for repeat cutting, because the steel templates take a lot of abuse before requiring replacement.

ELECTRONIC TRACERS

The big advance in steel shape cutting was the electronic or electric eye tracers. It was this development, more than any other, that promoted flame cutting into the machine tool class. It made the making, handling, and storage of templates easier and cheaper than the older tracing methods.

Eye tracers use drawn, taped, photo negative lines, or cutouts. And you can be much more accurate with these methods than you can in trying to coax steel, for instance, to conform to the part drawing.

Eye templates can be turned out in a fraction of the time fabricated ones can. They take no particular skill —just good drafting practice in most cases. They take little storage room; don't have to be maintained beyond reasonable care, as steel templates do; an unlike steel templates of any size, never have to be crane lifted.

Line drawings, used on line scanning machines (details below) are the simplest. One manufacturer estimates that line drawings are 75 percent cheaper to make than edge following templates.

Eye tracers use two scanning principles: Edge and line. Some eye tracers have a drive wheel which moves the cutting machine, and a servo mechanism which steers the drive wheel. The optical system of the edge tracer follows the interface between light and dark on the template. A small spot of light strikes the template and is reflected to a photocell system. A balance of light and dark keeps the tracer, thus the flame, on course. An excess of light or dark on the template, such as when the template has a curved line, causes the eye to steer toward the opposite condition, keeping the torch on course.

The other electronic scanning system follows a line. A small photocell oscillates across a pen, pencil, or photo negative line template. Thus it goes from light across the dark line into light again. As long as the photocell sees light on both sides of the line equally, no steering signal is produced; the unit will steer in the original direction. If it scans more light on one side of the line than the other (such as on a curve), the steering system causes the scanner to rotate in a direction to correct.

In the edge tracer, if the spot is entirely off the edge—entirely on a light or dark area—it will always circle in the direction to correct the error.

If the line tracer moves entirely off the line, no steering signal is produced and the unit will keep going in the original direction. Line systems usually have an auxiliary circuit which stops travel if the signal is lost.

TRACERS THAT FLOAT OVER TEMPLATE

There two other important developments in electronic tracing. Both eliminate driving wheel contact with the template, avoiding wear to the drawing and the need for a plastic cover. They are:

Roller Drive System: Drive wheel rides on a cross roll that runs the width of the tracing table—

Do you have Oxide-Scale Problems ?

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- *Prepares Stainless & Aluminum for Welding*
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not on the table. The wheel turns the roller or runs along it, moving the cutting machine carriages.

Coordinate Drive Systems floats over the template too. It uses a sine-cosine potentiometer (directional resolver) to coordinate the speed of separate drive motors in each carriage of the flame cutting machine. The photocell tracer continuously controls the resolver. The resolver is generally manually steered to the cut start.

Ratio Cutting is another significant development in electronic tracing. This system uses special gear ratios so that large templates can be drawn a fraction of full size—usually a fifth or tenth. Thus, drawing, handling, and storage are simplified. Line tracers are used with ratio cutting to reduce the error due to the reduced size template.

Another electric eye flame cutting development is kerf adjustment. The kerf (cut) width must be taken into account or parts will be undersize. It can be done by changing the size of the template. The new way, however, does it another way: The scanning spot is displaced to one side of the optical axis of the tracer. An adjustment on the unit—set according to the plate thickness—compensates for the kerf. This greatly simplifies the making of template drawings.

Tape Control is another step towards full automation in flame cutting. Its selection would be based on the need of a great number of parts, or of very large parts. Outlines must be translated into machine language with expensive computors; part nesting is difficult; and part use must be the same for each run of the tape for full speed and efficiency.

WATCH YOUR TEMPLATE MATERIALS

Template materials have a big effect on flame cutting quality. Flexible materials, like paper, bristol board, glass cloth, and plastic film are usually used for smaller parts. Inflexible materials, like metal, and tempered hard-board, are used for very large parts unless a ratio geared machine is used.

White drafting paper can be used if a few parts are required and if the template will be used as soon as it is made. If there is likely to be a delay, and the number of parts to be cut large, use dimensionally stable glass cloth or plastic film-base materials. The reason: Changes in humidity can change the dimensions of the templates, thus the parts.

Large, edge tracer templates are often made of white plastic tape against black tempered hard board background. Due to the large mass of this material, changes due to himidity are not rapid.

Other things affect the quality of cuts too: the accuracy of the cutting machine and the condition and alignment of cutting tips. Also, don't forget to take plate expansion into account: Support the part, not the scrap. • •

Ohmstede

SHAPE CUTTING MACHINES

Rigid construction . . easy cutting of unlimited shapes . . simple templet making . . . each machine a complete unit . . easily moved, whether on a portable or semi-stationary base . . . manufactured of high-strength aluminum alloys giving stability and rigidity under all conditions . . oversize, completely sealed anti-friction bearings . . all these features make OHMSTEDE SHAPE CUTTING MACHINES outstanding.

SPECIFICATIONS	Model SC-30	Model SC-42
Overall dimensions	36"x60"x58" high	36"x72"x59" high
Max. thickness of cut with std. blowpipe	8"	8"
Circle cutting range	0-30"	0-42"
Straight line cutting	65"	89"
Cutting speed inches per minute	3" - 30"	3"-30"
Electrical requirements	115V - AC/DC	115V - AC/DC
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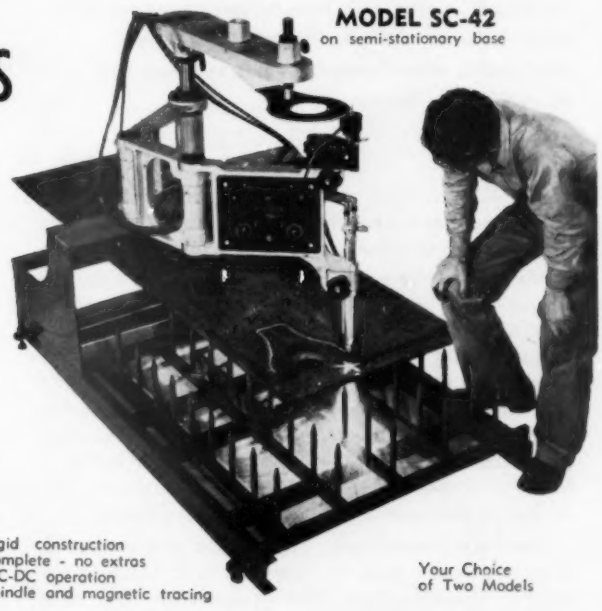

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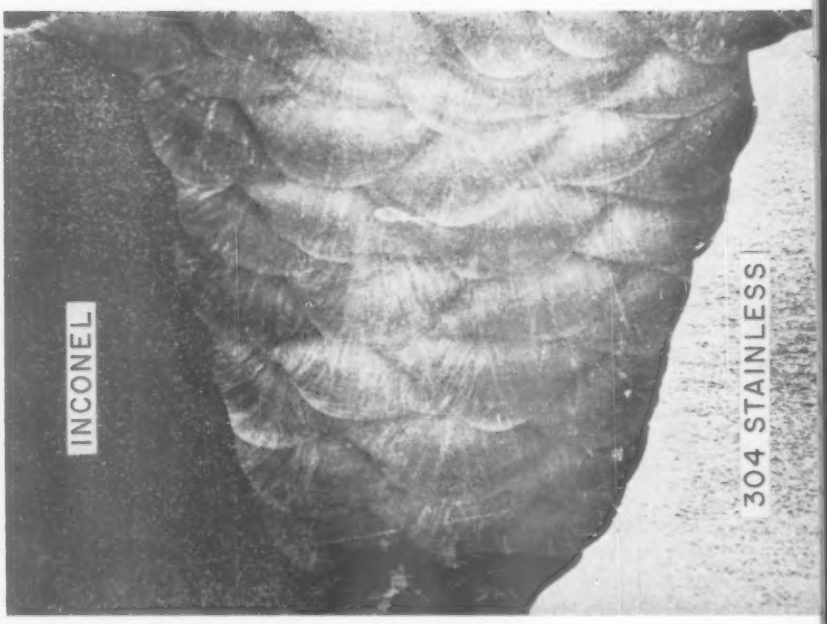
A WELDING SHOW FEATURE REPORT

The right way to join

you can weld, braze, and braze-weld many metal combinations successfully —if you pay close attention to these things: joint design, filler metal, stresses, corrosion, expansion differential, and code requirements



iN BRIEF: Author tells how to make pressure-tight joints between dissimilar metals three ways; what makes dissimilar-metal welds fail; and how to avoid these failures.

WHEN DESIGNS CALL FOR pressure-tight joints in dissimilar metals, welded, brazed, or braze-welded joints are usually better than a mechanical joint.

Welding makes the strongest joints and is the easiest to do in the field. It melts the base metals, dilutes the weld. This often changes weld properties.

Gas welding melts less base metal than arc welding. Manual arc welding usually penetrates the metal about 1/16 inch. This dilutes the weld next to the parent metal by about 20 percent. Submerged arc welding penetrates much deeper—diluting the base metal as much as 60 percent. Filler metals are usually similar to one of the metals in the joint for uniformity.

You can braze more metals than you can weld. Brazing doesn't melt the base metal, it bonds it by wetting. Properly done, brazing consumes little filler metal. The filler metal usually resists corrosion better than the base metals. Only drawback: braze metal shifts corrosion to the other metals in the joint.

Braze welding fills gaps between metals with a lower melting filler. It also bonds by wetting. The limited number of braze welding filler metals prevents its use for more dissimilar-metal jobs.

WHAT METALS CAN YOU JOIN?

If a metal can be welded to itself, chances are it can be welded to a different metal. Many combinations aren't practical, however, because the joints are brittle, weak, or unsound. Sometimes difficult-to-join metals can be resistance welded successfully.

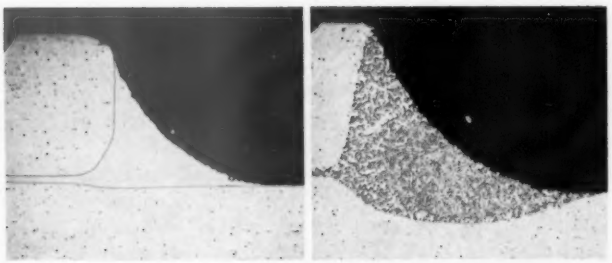
You can make sound welds in most steels, stainless steels, and nickel-base alloys—in any combination. You can join copper-base alloys to each other and to some nickel- and iron-base alloys. It's common to join alloys of aluminum and magnesium to metals like themselves. Alloys of titanium, zirconium, hafnium, beryllium, and columbium are welded to themselves.

What makes welds in dissimilar metals fail? The most common causes are mechanical or thermal fatigue. If both metals in a weldment don't expand the same, heating them may set up damaging stresses. For example: if you heat a stainless-carbon steel combination to 1000F., a stress of 75,000 psi develops. This is greater than the yield strength of either metal, and distortion always results.

You can avoid mechanical fatigue by keeping loads less than the metal's endurance limit. The endurance limit, by the way, is the greatest stress a metal will take and not fail (after a certain large number of cycles of stress). But if one base metal deforms plastically and the other elastically, the job will warp.

dissimilar metals

by **JAY BLAND**, *manager, Welding Development, Knolls Atomic Power Laboratory, Schenectady, (operated by G.E.)*



BRAZING: Penetration depends on the braze-metal filler. It's shallow (left) because the Inconel base metal is brazed with gold-nickel filler; deeper (right) because the filler metal is nickel-chromium-silicon-boron.

WELDING: Shielded arc weld between Inconel and Type 304 stainless steel made with a modified Inconel electrode. Root radius, 5/16 inch; included angle, 30 degrees.

Welds in dissimilar metals are generally as strong as the weakest metal. The weldments usually form as well as the least ductile metal. Tensile tests of carbon steel welded to stainless steel always break in the carbon steel; low-alloy and plain carbon steels are weak on low-temperature impact, but the filler metals for steel, stainless, and nickel-base dissimilar welds usually have good impact strength at low temperatures. Welds in different metals usually form as well as the most-ductile of the two base metals, but welding generally lowers heat affected zone ductility.

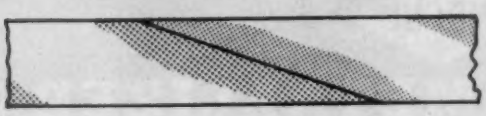
Galvanic action can corrode dissimilar-metal joints. If both base metals resist corrosion, so will the filler metal. Filler corrosion resistance is usually similar to that of the more resistant base metal. However, thermal stresses between the weld and the least corrosion resistant base metal may step up corrosion there.

The best way to avoid distortion in a weldment is to keep welding heat low and weld on alternate sides. One portion of a dissimilar-metal weld may shrink more than the other, distorting the weldment. A filler metal that is different from the base metals may effect distortion. The only way to determine this is to make a test weldment.

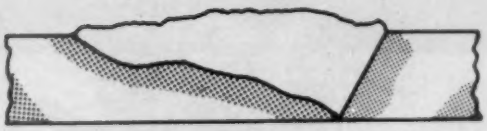
Stress relief reduces distortion in a weldment. But it can also harm one of the metals. For example, the usual 1,150 F.-stress relief for carbon- or low-alloy steels will precipitate carbides in unstabilized austenitic stainless steels.

continued on page 58

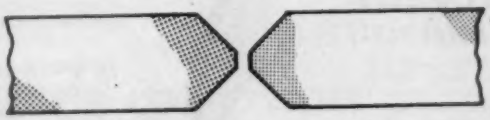
TYPICAL JOINTS FOR DISSIMILAR METALS



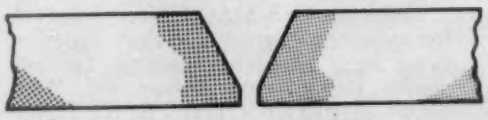
Ideal transition — uniform loading



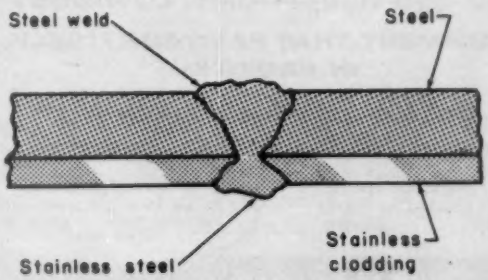
Good: Filler metal properties are like those of the base metal on the right.



Double V-groove for plate 1½" and thicker. Must be welded from both sides.



Single V-groove for metal thicknesses ¾" and under.



Joint for clad metal. Weld steel first. If total thickness is under ½", joint may be welded entirely with stainless.

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DISSIMILAR METALS

continued from page 57

Usually, weld stresses are in tension on the surface and in compression underneath. One tends to balance the other. This balance is compression if a ductile, weak metal joins a strong, less ductile, one.

Stress relief lowers residual stresses to the yield point of the metal at the heat treating temperature. For example, a carbon steel-austenitic stainless weldment joined with an austenitic filler metal and stress relieved at 1,150 F. will have these stresses: carbon steel, 6,000 psi; stainless weld and parent metal, as high as 20,000 psi. The unbalanced stresses can distort the weldment when service loads are applied.

If a weldment is to run hot and cold, its metals ought to expand alike. If heating is to be continuous but the atmosphere corrosive, expansion isn't as important as corrosion resistance. Similar yield strength and modulus will load the dissimilar weld uniformly.

When the choice of base metals is limited, choose a filler metal that expands somewhere between the two base metals. It will result in less stress. Also, you'll get better mechanical properties. The main thing: Be sure both metals will resist corrosion.

SECTION CHANGES: BASE METAL, NOT JOINT

Section changes ought to take place in one of the base metals, not at the joint. This will avoid a concentration of stresses in the weld.

Weld dissimilar metal equipment in the plant, especially if it is to be severely stressed. For instance, piping. It's better to make two field welds in similar metals than one in dissimilar metals.

A filler metal should not be chosen for ease of welding alone. For instance, 18-8 electrodes commonly used to weld 5 Cr, 0.5 Mo ferritic steel can cause joint failures two ways. It can lower shear strength in the heat affected zone by robbing the base metal of carbon; and it can increase shear stresses in these zones due to different base metal expansion rates.

Carbon also diffuses in ferritic steels having different chromium contents. Carbon migrates from the lower chromium to the higher chromium alloy.

Use stainless clad steel rather than stainless lined steel for a vessel that runs hot and cold. The cladding bond takes its share of the load from the uneven expansion of the two metals. When you weld the liners to steel compression and tensile stresses concentrate at the weld seam. And though the austenitic weld is ductile, it will eventually crack. And ordinary steel will corrode rapidly due to galvanic action once the stainless is breached.

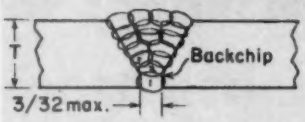
Codes, such as the ASME Unfired Pressure Vessel code, permit dissimilar-metal welds if the welding procedure is qualified by test. These tensile and soundness tests must be made for each job.

When the metals in a weldment are alike, their life can be estimated from base metal and filler metal properties and from qualification test data. When they are unlike or service is critical, more tests must be made to show the effects of thermal and mechanical fatigue. • •

A WELDING SHOW FEATURE REPORT

GOUGING a hole out of the stainless shell or heads is quickly done with carbon arc-compressed air.

WELDING of filter body joints must be done to Dollinger specifications. This one covers Double-V butt joints in ¼ to ¾-inch stainless steel for flat position welding.



T	No. of Passes	Pass No.	Electrode Diameter	Arc Volts	Current Amps
3/16	3 ±0	1, 2, 3	1/8	23	90
1/4	4 ±1	1, 2, 3, 4	1/8 5/32	23 25	90 125
3/8	7 ±2	1 to 2 3 to 8	1/8 5/32	23 25	90 125
1/2	11 ±3	1 to 2 3 to 11	1/8 5/32	23 25	90 125
5/8	16 ±4	1 to 2 3 to 16	1/8 5/32	23 25	90 125
3/4	17 ±4	1 to 2 3 to 17	1/8 5/32	23 25	90 125

THE PRODUCT: A vessel of Type 304 stainless steel rated at 150 psig.

HOW IT WORKS: The filter traps foreign matter two ways: mechanically, and by filtering. A cup deflects the incoming fluid to the walls of the base (high speed). The contaminants drop out (for regular draining). The mechanically-clean gas rises (slowly) through a radial-fin insert which filters out airborne materials.

Stainless filter tames corrosion

IN BRIEF: Filters, like other industrial equipment, are being made of metals that withstand heat, corrosion, and pressure. A stainless filter for chemical processing is described.

It would be hard to find a plant that didn't use filters of some type. Filters, remove dust, moisture, oxides, gums, and oils that clog valves, gum up regulators, contaminate products, and even shut down entire distributing or manufacturing processes.

Gases and liquids used by industry and utilities are really only comparatively clean. They usually contain —or pick up—impurities that can damage equipment or ruin the product. Stopping them is the filter's job.

Dollinger Corporation (Rochester, N. Y.) makes all types of filters: pipe line filters for low and high pressures and temperatures; liquid filters; gas filters; and intake filters. Some are tiny, some are huge. Some trap particles as small as 0.5 microns (that's less than .00002 inches). The metal parts of most filters are low carbon steel; but the number of aluminum, titanium, and stainless steel filters coming out of the Dollinger plants is increasing.

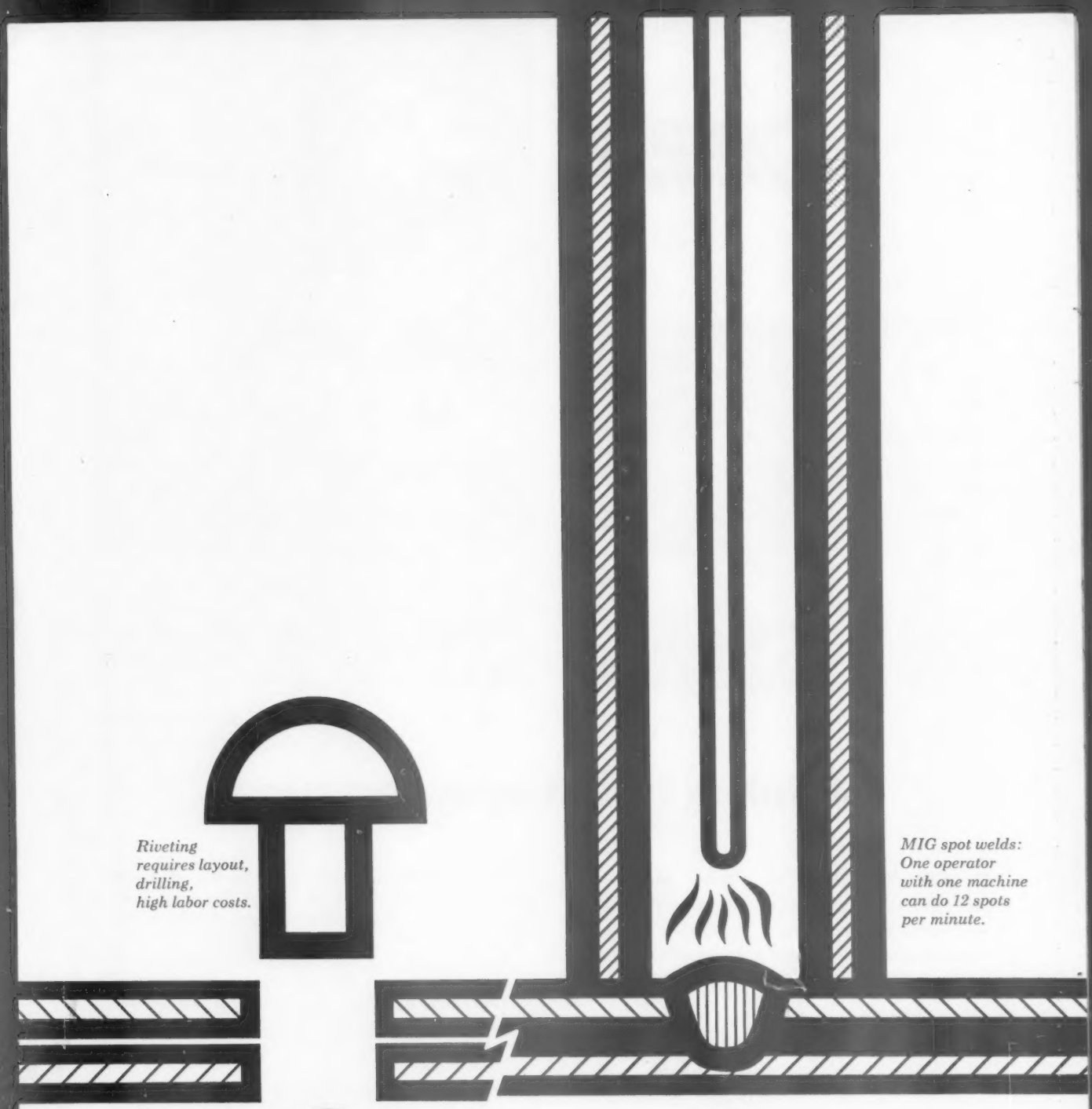
We visited Dollinger's research director, E. Grant Pike, during fabrication of several 150 psig stainless steel filters. These filters, we learned, will go into the process line of a big chemical producer.

These 18-inch-diameter, 50-inch-long vessels are of type 304 stainless so that the acids, salts, and other contaminants they stop won't corrode the vessels. Shell and dished-head thicknesses are ¼ inch; bands (the part to which the removable head is swing bolted) is ½-inch thick.

"We follow careful fabricating and welding standards for two reasons," Pike said. "We are proud of our reputation in the filter business, and we must satisfy Hartford Boiler Inspection."

Not only do Dollinger craftsmen adhere to high standards (see welding table), they use the latest equipment and processes. Example: They back-gouge shell and head welds with carbon-arc compressed-air. This process is used on other work too. It is used to cut holes in heads and shells for fittings. They use a ¼-inch electrode and 370 amps current.

The Hartford Inspector checks the first pass and the last one. Then, when the job is done, he views the radiographs of the welds. If the vessel passes this, . . . and a 1-½-times working pressure hydrostatic test, the filter body gets the Hartford stamp of approval. • •



Riveting requires layout, drilling, high labor costs.

MIG spot welds: One operator with one machine can do 12 spots per minute.

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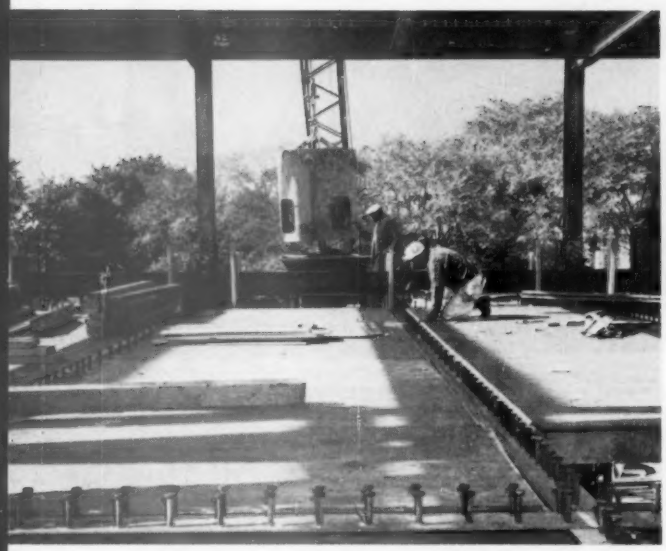
A WELDING SHOW FEATURE REPORT

Stud welded shear connectors: The new key to construction strength

by **HENRY LEFER,** *eastern editor*



IN BUILDINGS, like this addition to Princeton University's Guyot Hall, composite construction helps reduce weight and cost of steel framing. Here, studded beams are in place and plywood forms are being laid before concrete is poured.

IN BRIDGES, like this one fabricated and erected by U. S. Steel's American Bridge Division, composite construction permits use of light steel sections with resulting savings in steel fabrication and sub-structure costs.

IN BRIEF: Laboratory tests show the effectiveness of ½-inch diameter welded stud shear connectors. This may lead to lighter, stronger, more economical designs for bridges and buildings.

BRIDGES AND BUILDINGS can carry heavier loads when they are built with "composite construction."

Concrete is poured over shear connectors (channel irons, spirals, studs, or similar devices) welded to the steel beams. The shear connectors transfer the load between the two materials. Instead of being a dead weight, the concrete helps the steel carry the load.

This advantage can be used two ways in bridges, buildings, wharves or docks: A heavier load may be carried, or less steel may be used.

Example: In a recent building addition at Princeton University,[1] composite framing required 3,568 lb. of steel for each bay. Conventional steel framing would have required 5,434 lb. The steel cost, including stud shear connectors, was $604 per bay. Conventional framing would have cost $760.

In a bridge or overpass of composite construction, the concrete deck helps carry the load so the designer can use lighter steel. This permits greater headroom clearance under the beams or allows the use of lower approaches.

Despite these advantages, composite construction has not been used as widely as it might have been. One thing against it, the most important, has been the expense of the shear connectors, the equipment needed to weld them, and the difficulty of welding them in the field. But recent studies of welded stud connectors may cut these costs.

Professor Bruno Thürlimann and others[2] made several studies at Lehigh University. Dr. Thürlimann is a leading authority on structural and composite design. Sponsor was K S M Products, Inc., of Moorestown, N. J. The American Assn. of State Highway

continued on page 62

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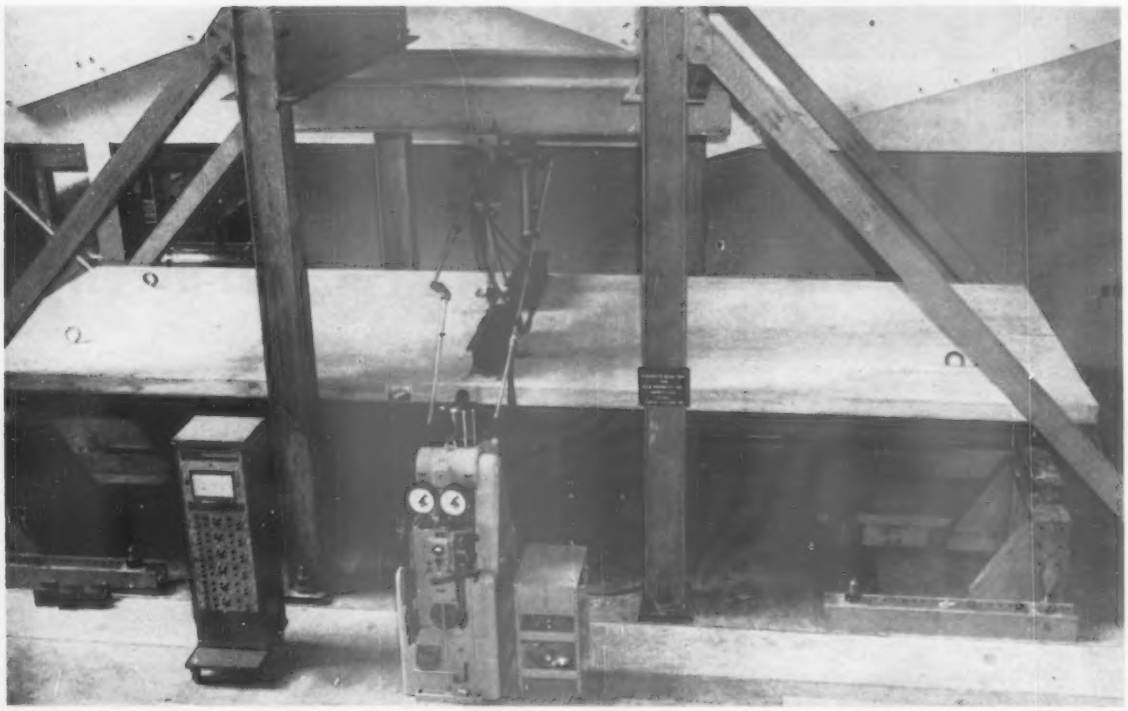
Tests like this one were made to compare



TESTS ARE MADE on composite structure with 6-inch concrete slab tied to two steel beams by shear connectors (¾-inch headed studs and ½-inch L-shaped studs). Test rig includes variable loading equipment and jacks for applying load.

Officials and the American Institute of Steel Construction examined the results. This may lead to revisions in specifications governing composite construction.

Thürlimann showed you can use smaller diameter stud connectors than were though necessary. Smaller connectors need comparatively simple and inexpensive welding equipment and less-expensive studs can be used in the field.

There are various types of shear connectors. To look at them, you'd never think that they all have the same function: To transfer horizontal shear forces between steel and concrete.

There are flexible connectors, such as headed studs (resembling bolts) and L-shaped studs, channels and bulb angles, spirals (long, heavy coils), and rigid connectors, such as bar stock and angle irons.

Flexible connectors differ from rigid connectors. They give under load. They come back to normal position when the load is released. Most connectors now used are flexible.

Channels and bulb angles are cut to lengths of 4 to 10 inches and welded, at set distances apart, transversely across the flange of the I-beam. Their webs are elastic, and their top flange keeps the concrete slab from rising off the I-beam flange. They are fairly easy to apply, and their top surfaces provide a walkway for men working on the beam. But, welding the channels on is expensive and it distorts the beam, requiring the recambering of the beam's top flange.

The spiral connector is a steel rod usually ½" to ¾" in diameter formed into a coil with varying pitch. The coil goes length-wise along the I-beam flange and runs the length of the beam. It is welded at every point it touches the beam's flange. The spiral is an excellent shear connector, but expensive and costly to attach. Handling spirals is difficult. They tend to nest, tangle, and get out of pitch. Usually applied in the shop, they make the beam awkward to ship and are apt to suffer shipping damage.

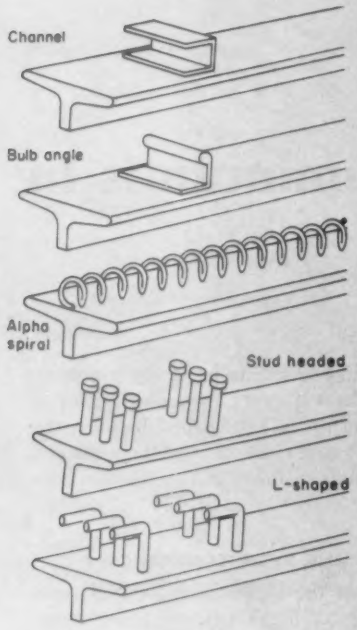
Stud connectors are also effective shear connectors when substituted for equivalent lengths of channel, bulb angle, or spiral. They can be applied faster than the others. On one New Orleans bridge job, an operator stud welded eighteen ¾" stud connectors in one minute.

Studs eliminate the cost of electrodes and the cost of cutting channels to length. They give excellent penetration and don't cause heat distortion. Tests indicate there is less danger of concrete cracking around the connector with studs than with channel or bulb angle. In channel failure, the whole area around the connector usually crushes.

Early tests led to this table of equivalencies between channels and ¾"-diameter stud connectors:

Channel	*Lineal inches of channel equivalent to 1 welded stud shear connector (¾"-dia.)*
3" x 4.1 lb.	2.25
4" x 5.4 lb.	2.00
4" x 7.25 lb.	1.75
4" x 13.8 lb.	1.25

these flexible connectors and get this data



NUMBER OF STUDS EQUIVALENT TO 1" OF CHANNEL								
STUD DIA.	SIZE OF CHANNEL							
	3-in. 4.1 lb.	3-in. 6.0 lb.	4-in. 5.4 lb.	4-in. 7.25 lb.	4-in. 13.8 lb.	5-in. 6.7 lb.	5-in. 9.0 lb.	6-in. 8.2 lb.
¾"	0.450	0.451	0.490	0.558	0.761	0.531	0.597	0.572
⅞"	0.331	0.397	0.360	0.410	0.559	0.390	0.439	0.420

NUMBER OF STUDS EQUIVALENT TO ONE PITCH OF SPIRAL			
STUD DIA.	DIA. OF SPIRAL BAR		
	½ in.	⅝ in.	¾ in.
¾"	1.39	1.74	2.09
⅞"	1.02	1.28	1.53

USEFUL CAPACITY OF ONE STUD IN POUNDS				
STUD DIA.	CONCRETE STRENGTH (PSI)			
	2500	3000	3500	4000
¾"	9,300 lb.	10,200 lb.	11,000 lb.	11,800 lb.
⅞"	12,700 lb.	13,900 lb.	15,000 lb.	16,100 lb.

Design load = Useful capacity / Safety factor

For ½" studs, divide ¾" stud figures by 2¼ (AASHO recommendation) or 1½ (Thürlimann-Lehigh tests).

FLEXIBLE CONNECTORS like these are available to transfer horizontal shear forces between steel and concrete. Some results of tests made on these different types are shown at right.

Example: If the design of the structure calls for 5 lineal inches of the 4" x 13.8 lb. channel, four of the ¾" stud connectors could be used instead.

Thürlimann's work carries this further.

It had been thought that the effectiveness of a stud connector depended on it's cross-sectional area. Thus, one ¾"-dia. stud would be equivalent to two-and-one-quarter ½"-dia. studs. Thürlimann tests show this may not be completely true. His tests show that the effectiveness depends largely on the diameter; that is, on the surface contact between the steel and concrete. The larger diameter stud seems to crush the concrete more, making it a less effective connector. Since the ½" diameter stud can be stressed to its ultimate without concrete crushing, the 2¼:1 ratio probably can be substantially reduced.

Thürlimann tests also indicate that the substantial part of the shear transfer action takes place within the first two inches of the connector's length.

Thürlimann made his tests on ¾" headed connectors and ½" L-connectors. But other tests underway indicate the behavior of a connector depends more on it's diameter than its shape.

The conclusions drawn from these findings are:

- A smaller number of ½" studs than had previously been specified will develop the shear transfer required in any given design.
- Studs shorter than previously considered necessary can be used.

When governmental and trade organizations accept these conclusions, the reduced cost of installation of ½" diameter stud shear connectors should increase the use of composite design in steel and concrete structures.

Thürlimann's findings have already received gratifying endorsement. The State of Michigan just recently let out for bids a bridge design using ½" connectors. Michigan's design is conservative, using a factor of about 1:2 for converting ¾" stud connectors to ½" stud connectors. But stud connector proponents were pleased with the change. This is the first large bridge specifically designed to take advantage of the shorter ½" connector.

Another indication that the ½" stud connector is being given considerable attention comes from the State of Maryland. They recently revised bridge specifications include the ½" stud as an alternate shear connector.

Reducing the number of ½" studs required to replace a given length of channel or a given quantity of ¾" studs now specified makes their use even more economical.

Not only are they less expensive, but they can be applied with much less power. Welding power can be supplied by a 600-amp motor-generator set or 110-v 800-amp battery unit, costing about $900 and available anywhere. Heavy-duty, 3-phase welding machines or diesel-driven motor-generator equipment is needed for ¾" studs, which cost about $9000.

continued on page 69

A WELDING SHOW FEATURE REPORT

MIG spot welding of aluminum is in; Riveting is out!

IN BRIEF: A 2-year research program shows MIG spot welding can be used instead of riveting on nonstructural aluminum products; it eliminates layout, drilling, punching, bolting, and will reduce labor and cut costs.

THE MIG SPOT WELDING PROCESS is now recommended for joining aluminum by Olin Mathieson Chemical Corp. The company is offering industry the procedures and test data resulting from a 2-year research program. This program shows properly designed joints give MIG spot welds that are as strong as rivets or spot welds. The MIG spot welding process was first developed for use on steel and was not used widely on aluminum because it was hard to get consistent results.

HOW IT WORKS

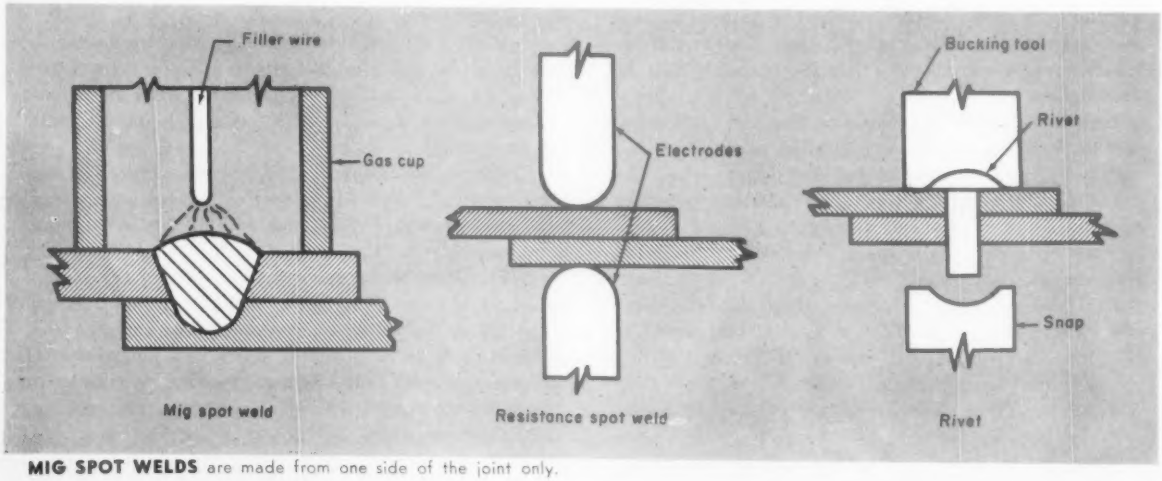
An arc (direct current, reverse polarity) is maintained between the aluminum alloy electrode and the work in an argon atmosphere. The operator adjusts the wire feed, arc voltage, and other controls according to the thickness of the metal and the type of joint. He brings the nozzle of the gun into contact with the work, applying enough pressure to bring the two members together. He pulls a trigger. Through a series of relays and timers, the arc is established between the consumable aluminum wire electrode and the work and maintained long enough to fuse the two members together.

SOME APPLICATIONS AND THEIR ECONOMICS

Olin Mathieson feels the biggest use for MIG spot welding will be for fabricating nonstructural aluminum products now being riveted and for tack welding subassemblies prior to making the final weld. MIG will eliminate layout, drilling, punching, and bolting. It will cut labor and reduce costs. As a rough rule, MIG spot welding can cut joining costs in half as compared to what it now costs to rivet.

An example: Figure the cost of fabricating a riveted aluminum external post truck trailer 8-feet-wide, 8-feet-high, and 40-feet-long. The external 0.125-inch-thick top hat extrusions are placed at 24-inch centers. About 4,000 rivets attach the 0.062- or 0.051-inch trailer sheet to the top hat sections. For comparison, let's use the same number of MIG spot welds to attach the trailer sheet to the frame:

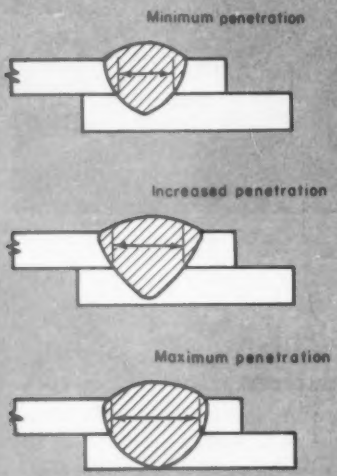
continued on page 66

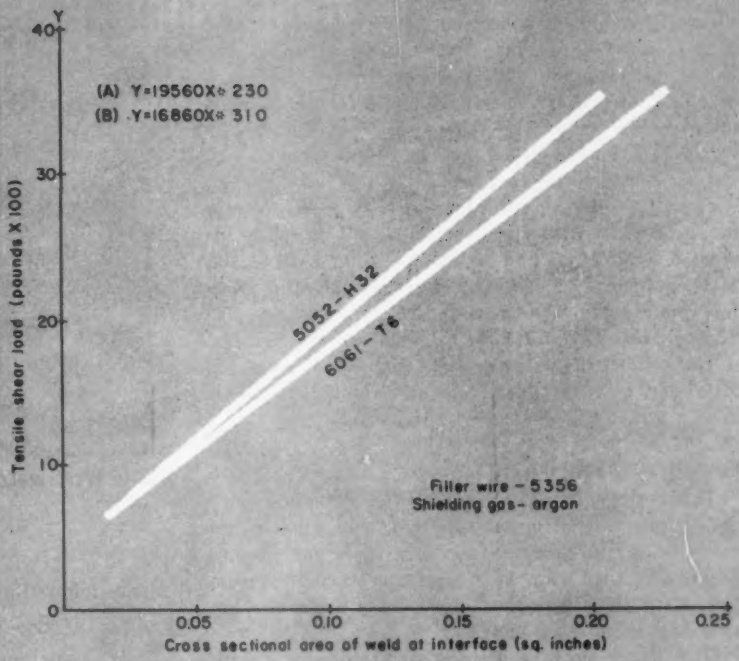


MIG SPOT WELDS are made from one side of the joint only.

Tensile shear load vs. cross sectional area at weld interface

PHYSICAL PROPERTIES and consistency are directly related to the cross sectional area of the weld at the joint interface. The cross sectional area, in turn, is related to the depth of weld penetration into the lower member. The weld is shaped like a cone whose apex occurs in the bottom sheet of the joint. As penetration increases into the lower sheet, the weld area at the interface increases with a corresponding increase in strength.





Comparison of tensile shear properties

Aluminum Alloy	Thickness (inches)	Tensile shear properties of joints		Rivets*** (lbs./rivet)
		MIG spot welds* (lbs./spot)	Resistance spot welds** (lbs./spot)	
3003-H14	0.050	540	320	400
"	0.063	535	455	505
"	0.080	795	610	640
"	0.125	955	840	745
5052-H32	0.050	770	345	620
"	0.063	745	490	745
"	0.080	1180	685	745
"	0.125	1060	1300	745
6061-T6	0.050	685	345	745
"	0.063	695	490	745
"	0.080	1140	685	745
"	0.125	1080	1300	745

COMPARISON OF JOINT STRENGTH: Samples containing two spots were tested to determine the tensile shear values of MIG spot welds in a number of alloys and thicknesses. Maximum penetrated joints were tested. The values obtained were based on an average of 20 samples. These results were compared with tensile shear properties of riveted and resistance spot welded joints as shown above.

*Average values for completely penetrated welds made with 5356 filler.
**Design values for resistance spot welds as specified by Military Specification MIL-W-6858A.
***Calculated design values for 3/16 inch diameter 2117-T4 rivets.

MIG SPOT WELDING ALUMINUM

continued from page 64

One large manufacturer who uses rivets needs 18 men to keep his assembly line going. MIG spot welding could do the job with six men because it is not necessary to punch holes and insert rivets manually.

MIG spot equipment (eight machines and a jig) would cost about $30,000. A squeeze riveter costs more than $50,000. The riveter would probably be written off over four years, the MIG equipment over two or three years. To be conservative, let's write off the welding equipment in the first year:

Capital equipment costs for the MIG process would be about $15 a trailer against $6 for riveting. The increased production and lower operating cost of the MIG equipment offsets this difference. Operating costs for riveting the side posts to the trailer sheets are $236 a trailer, against $100 for welding.

The estimated total operating and capital costs for MIG spot is $115 a trailer. For riveting, it's about $242 a trailer.

MIG SPOT WELDING joins ribs of 14-foot aluminum boat to the hull.

EQUIPMENT REQUIREMENTS

This is the equipment you need for MIG spot welding: Direct current power supply, a wire drive mechanism fitted with necessary controls, argon gas, cooling water, and filler wire. Most equipment manufacturers can supply them because the process is being used on steel and some other metals.

Olin Mathieson feels best results are produced with a power supply that has rising volt-ampere characteristics.

The total cost of equipment for MIG spot welding is about $3,000. When standard MIG equipment is available, you can convert it by adding a second control panel and a new gas cup. These cost about $400. If you must buy a power supply with rising-characteristics, figure on another $1,200.

WHAT ALLOYS ARE WELDED?

Any aluminum alloy you can weld with conventional MIG equipment can be MIG spot welded. These include the 1,000, 3,000, 5,000, and 6,000 series. There is not yet enough data to recommend the process for joining the 2,000 and 7,000 series.

You can join aluminum from 0.030 to 0.187 inch thick. Material heavier than that can be MIG spot

continued on page 68

ADVANTAGES OF MIG SPOT WELDING

1. One operator can make as many as 12 spots a minute. With good holding and locating jigs, he can make up to 500 spots an hour.
2. No drilling or hole punching is needed.
3. Welds can be made from one side of the joint only.
4. No cleaning of base metal is needed.
5. MIG spot welding equipment is available from a number of manufacturers. A complete unit including power source and controls costs about $3,000.
6. Equipment is compact and portable. It is not limited by throat depth, as is resistance welding.
7. Highly skilled operators are not required where minimum penetration can be tolerated.
8. One side of the joint is free from any sign of weld, improving appearance.
9. There is little distortion of base metal.
10. Welds are strong. Shear properties are as high as joints made with 5/32-inch 2117-T6 rivets.
11. Fatigue properties are higher than those of riveted or resistance spot welded joints.
12. Corrosion resistance is equal to that of the alloy welded.

THESE ARE THE LIMITATIONS

1. Not now usable on material lighter than 0.030-inch. Back-up needed to control penetration on welds in material from 0.030 to 0.051 inches.
2. MIG spot welding should not be used to join unequal thicknesses if the weld is to be made through the heavier member—unless you can tolerate complete penetration of the thinner sheet.
3. The process cannot yet be used on high strength, heat-treatable alloys (2,000 and 7,000 series) but can weld the 6,000 series without difficulty.
4. Defects like porosity and cracks may be encountered in production. However, tests show these defects are found near the surface of the weld and not at the fused interface. This means they have no influence on the shear properties of the welds.

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5 Fast, Easy, Headgear Adjustments - Minimum Parts

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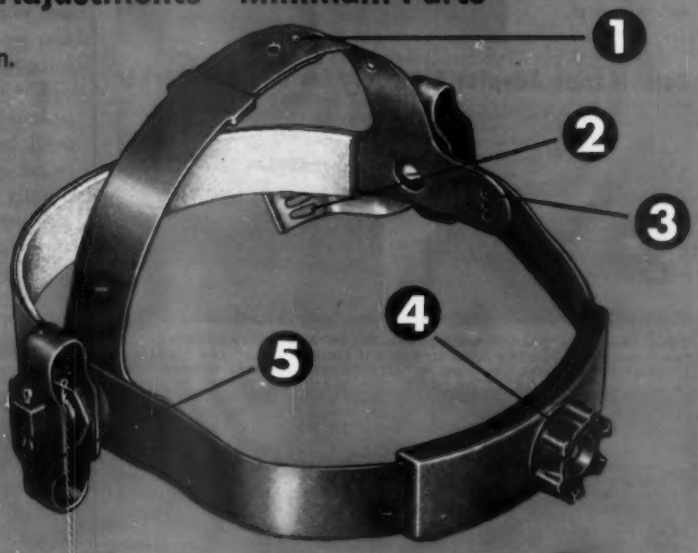
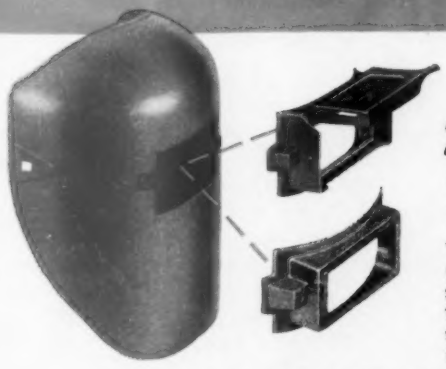
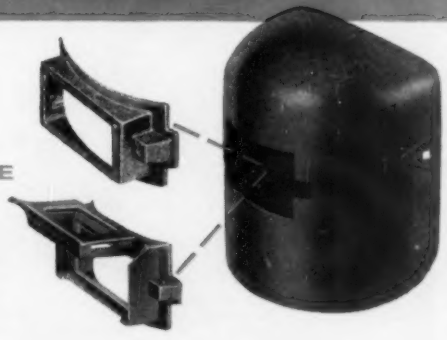
2. Three-position stop for lowering helmet.
3. Fast, simple, pinlock, rear section adjustment to ball of head.
4. Large, easy to grip, long-life, nylon ratchet adjustment to desired head size.
5. Four position, swivel lock adjustment for raising, lowering and in-and-out positioning in relation to face.





2 EASILY INTERCHANGEABLE FRONT FRAMES

Two screws—easily removed and inserted—and you can switch fixed or lift front frames to either curved or straight Welsh fiberglass shells.



One headgear, two front frames and two basic shells from Welsh—the simplest, most complete welding helmet protection! Easiest, fastest headgear-to-helmet assembly. Foam sweat band for extra comfort. Write today for bulletin and prices.

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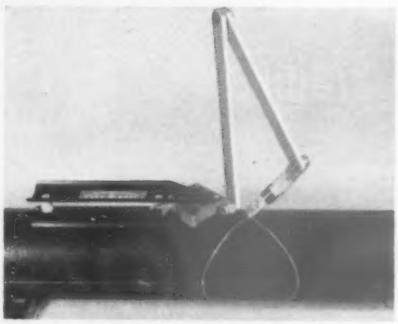
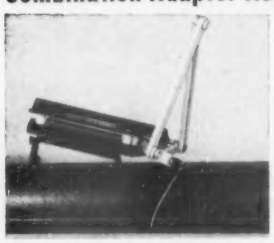
Marks off any pipe joint or structural angle. Cut accurately, easily and without figuring cutbacks. Marks all around pipe. Saves time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diameter.



Combination Adaptor Accessory for Contour Marker



This new tool patent will prove to be a great advantage to the layman, allowing him to use all four sides of the Contour Marker in layouts on pipe or structural steel. It allows him to mark up to 30" pipe with the standard model without having to quarter or halve his pipe as he has had to do in the past. It allows him to mark over nipples, old welds, without having to break the wrap so far back on wrapped pipe.

It allows him to mark compound angles in one setting of the tool, also to mark off any portion of tube turns or 90 degrees he would so desire, as you will note in self-explanatory pictures.

The combination adaptor will also be furnished for the Jumbo Contour Marker on special order.

This tool will be sold by your welding distributor as an accessory to the Contour Marker.

Pro - Mag - Level

This level is designed for the fitter, welder, jig builder, for any layman who has angle or setting problems. The Pro-Mag-Level is 9" in length, 2" high, ¾" wide, weighing a total of 10 oz., a convenient pocket size. One side is machined to a flat plane for flat surfaces, the other side is machined to a slight V-plane for pipe work.

Body of level is made of strong aluminum casting to maintain lightness of tool. Scales are imprinted on one end for rise in degree per foot, on the other end degrees in rise per meter are imprinted.

Equipped with level and 90 degree dial marked in 2½ degrees, held in place by screw with pressure washer for easy setting.

Frame of level is equipped with two magnets on each plane for holding level in desired position, allowing the layman a third hand. Pictures of tool are self explanatory.

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MIG WELDING ALUMINUM

continued from page 66

welded if you increase the diameter of the filler wire 1/16 inch to 3/32 inch. Use a back-up with lighter gages (particularly under 0.051 inch) to prevent burn through and scarring of the under member. Olin Mathieson recommends using 5356 filler metal on all aluminum alloys in all thicknesses. It is harder and more rigid than 1100 or 4043. Its high strength as-cast makes welds with better mechanical properties.

You can weld lap, corner, butt, and T-joints. Use specially designed gas cups for best results.

FIT-UP IS IMPORTANT

To get high quality welds consistently, keep the members being welded in intimate contact. If they are not, molten metal will be expelled between the two pieces, or there will be excessive penetration and burn-through.

The choice of welding procedures is usually a compromise between weld strength and appearance. You need maximum penetration into the bottom member to get high shear, impact, and fatigue properties. This usually will result in some scarring of the exposed member unless a back-up is used. However, when good appearance on the outside member is paramount, you can adjust the degree of penetration and the marking or scarring of the exposed member to the desired level. You can maintain total strength by increasing the number of spots welded.

COMPARISON OF JOINT STRENGTHS

Technicians measured the tensile shear strength of samples containing two MIG spot welds in a number of alloys and thicknesses. They tested maximum penetration joints. The values are based on an average of 20 samples. They compared the results with the tensile shear strength of riveted and resistance spot welded joints.

This data shows that adequately penetrated MIG spot welds are higher in tensile shear properties than resistance spot welds or for joints riveted with 2117-T4 rivets. The less the penetration, the lower the strength and consistency of the welds. However, this does not happen when the weld is made through light metal onto a heavier member.

Olin Mathieson technicians tested spot welded samples under impact shear conditions. They compared the results with the calculated properties of joints riveted with 2117-T4 rivets. No data was available on impact shear values of resistance spot welds. But, there is enough evidence to confirm that their impact properties are lower than riveted joints. The study by Olin Mathieson shows that the impact resistance of MIG spot welded joints is appreciably higher than riveted joints.

Other tests showed that the fatigue values for MIG spot welds compare favorably with those of riveted joints. Broken MIG spot welded fatigue samples showed that the fatigue failure started at the weld nugget and spread to the outside edge of the test piece through the backing strip. Only a few samples failed in fatigue by shearing through the weld. • •

STUD WELDED SHEAR CONNECTORS

continued from page 63

These developments put stud welding within reach of the smaller contractor, widening the area for bids. It also does away with the need for welding the studs in the shop. Then contractor has the advantage of working with uncluttered steel. Erectors can walk the beams easily and safely to lay forms, etc. They can then apply the studs at their convenience before pouring concrete.

Flexibility in location of the studs also gives the erector greater latitude in placing reinforcing rods.

WHAT WERE THE LEHIGH TESTS?

Thürlimann made two series of tests.[2]

For the first, he built a full-scale composite beam structure according to a design prepared by the Bureau of Public Roads. He placed it lengthwise on end bearings, subjected it to fatigue tests, and then static tested to destruction. This is believed to be the first time anyone has tested the strength of shear connectors with a set-up simulating actual bridge loads.

The test structure consisted of a 6-in. deck slab 32 ft. long and 10 ft., 11 in. wide and two 18WF50 beams 32 ft. long. To the top flange of one beam were welded ¾"-dia. x 4" high headed studs; to the other ½"-dia. x 1-⅞" high L-studs.

The loading program consisted of 1 million cycles with maximum load equal to 100 percent, an additional 250,000 cycles at 125 percent, and a further 250,000 cycles at 150 percent of the design live load.

Both types of shear connectors behaved satisfactorily under all testing conditions. Failure finally occurred in the concrete slab, not in the connectors, under static load equivalent to more than 5 times the design live load.

He made his second series of tests to get additional information on the fatigue behavior of the connectors. This also involved ¾"-dia. headed connectors and ½"-dia. L-connectors. These tests were the push-out type, which has been widely used for determining the static strength of shear connectors.

Results of both series reinforced each other. Both indicated that past design for stud shear connectors has been overly conservative. • •

1. Biological Laboratory Addition, Guyot Hall.
   Princeton University
   O'Connor & Kilham, Architects.
   Seelye, Stevenson, Valve & Knecht, Structural Engineers
2. Thürlimann, Bruno
   "Composite Beams with Stud Shear Connectors"
   Highway Research Board, National Academy of Science
   Bulletin 174, 1958, P. 18.
   Thürlimann, Bruno
   "Fatigue & Static Strength of Stud Shear Connectors"
   ACI Journal, Vol. 30, June, 1959
   Culver, Charles and Coston, Robert
   "Tests of Composite Beams with Stud Shear Connectors"
   Fritz Laboratory Report No. 354.1, April 1959,
   Lehigh University

Settling filter chamber fabricated of SA-302 manganese moly. steel to operate at 2400# pressure and at 1200°F.

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A WELDING SHOW FEATURE REPORT

Will your next car have a one-piece brazed stainless steel block?

by **SCHOLER BANGS,** *western editor*

THESE STAMPINGS are furnace brazed to make the block for this 175 hp engine.

IN BRIEF: Stainless steel stampings are furnace brazed to make a single-unit block, including cylinders, and head for a 175 hp water-cooled 4-cylinder engine.

BRAZING HAS BRED a brand new family of powerplants for cars, motorboats, and other industrial uses.

A new 175-hp water-cooled 4-cylinder engine does not have the usual heavy cylinder block and bolted-on cylinder head castings. Its single-unit block, including cylinders, and head are stamped of thin stainless steel.

Welding these stampings together would have been too expensive. Some joints would have been inaccessible. So, the maker tack welds the stampings and then furnace brazes them.

THESE ARE THE RESULTS

- The cylinder block weighs only 37 lb. A cast aluminum block would weigh 68 lb. In spite of its lightweight, the brazed cylinder block is surprisingly strong. It tolerates compression ratios that would destroy conventional engine assemblies. The crankshaft speeds can go up to 8,000 rpm.

- There is no compression pinging because cylinders have uniformly thick walls. There are none of the hot spots found in conventional cast blocks.

- The engine can hold a compression ratio up to 14:1, because there is no head gasket to blow out and because of the freedom from hotspots.

- The 175-hp powerplant delivers 1 hp per pound of engine weight.

- A 135-cubic-inch engine produces up to 175 hp at 6,500 rpm. Compare this to the 101 hp produced at 4,400 rpm by a 170-cubic-inch engine in a current U.S. compact car.

Tyce Engineering Corp. of Chula Vista, Calif., de-

continued on page 75

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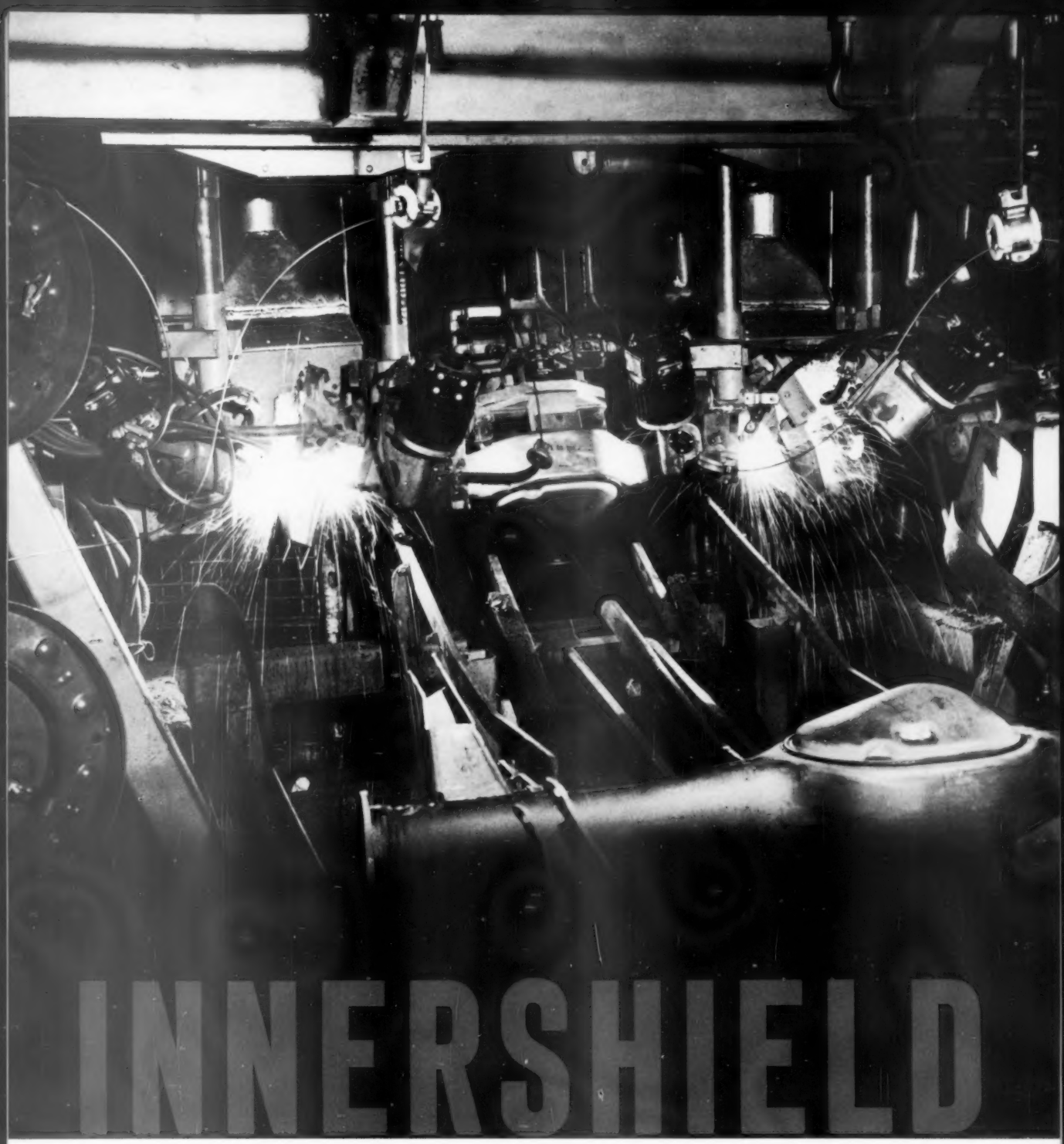
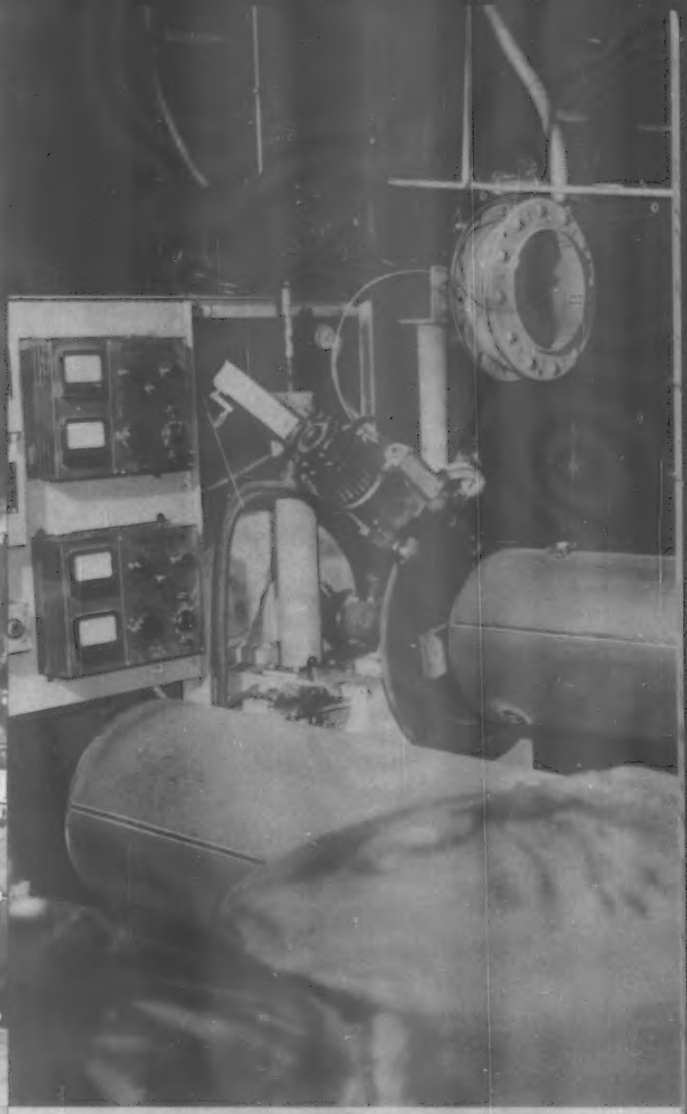


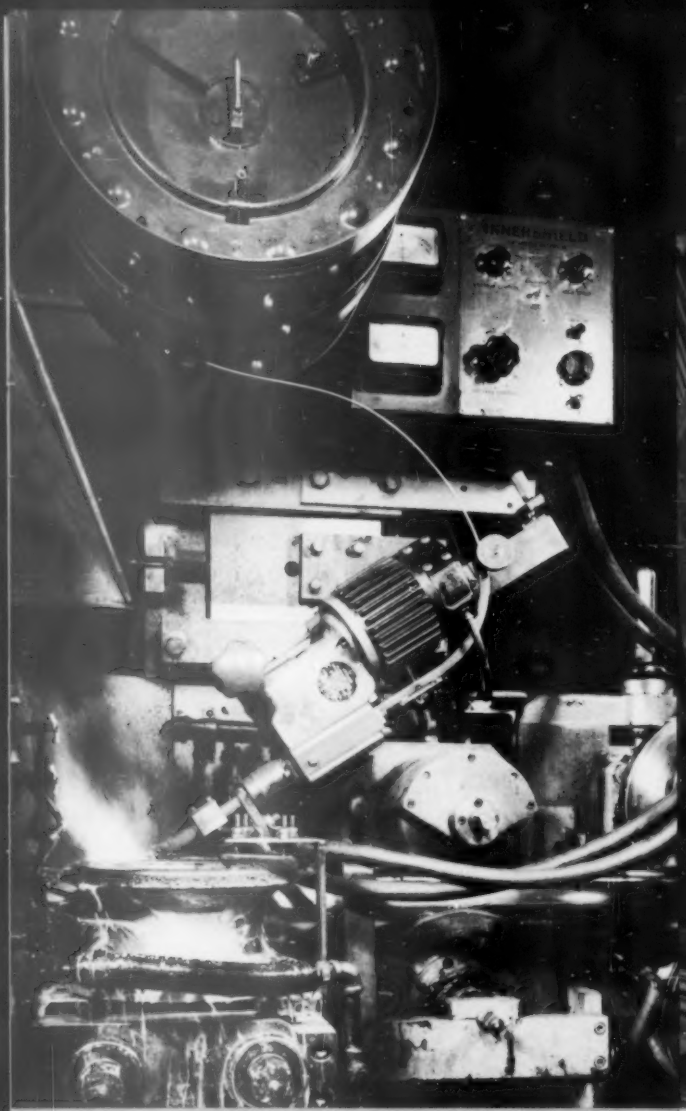
Speed. Simplicity. Low cost. These you get with Lincoln full-automatic Innershield... a new process that welds up to 300 ipm. Tubular electrode contains all ingredients for welding. Needs no CO_2, Argon or granular flux. Unbelievable? Read all the facts about this amazing process.

Innershield makes automatic welding of difficult corner welds easy. Poor fit-up conditions are handled at an average speed of 90 ipm, five times faster than previous hand welding techniques. And the operating factor is vastly improved, too.



Dual-head setup welds water tank end shells complete in 12 seconds! No costly slag removal problem. No need for expensive piping and manifolding as with gas-shielded processes. Inventories and storage space reduced, purchasing simplified.

THIS IS FULL-AUTOMATIC
INNERSHIELD
ON THE JOB



Innershield makes continuous butt weld at 120 ipm. Special tubular electrode eliminates flux used in submerged arc process and intricate manifold system of inert gas process. Reduces inventories, simplifies purchasing, cuts storage space.

Semi-automatic Innershield Squirt is ideal for short, intermittent, single-pass welding on parts such as these building trusses. Weld quality improved. Continuous 50-pound coil electrode eliminates time-consuming electrode changing.

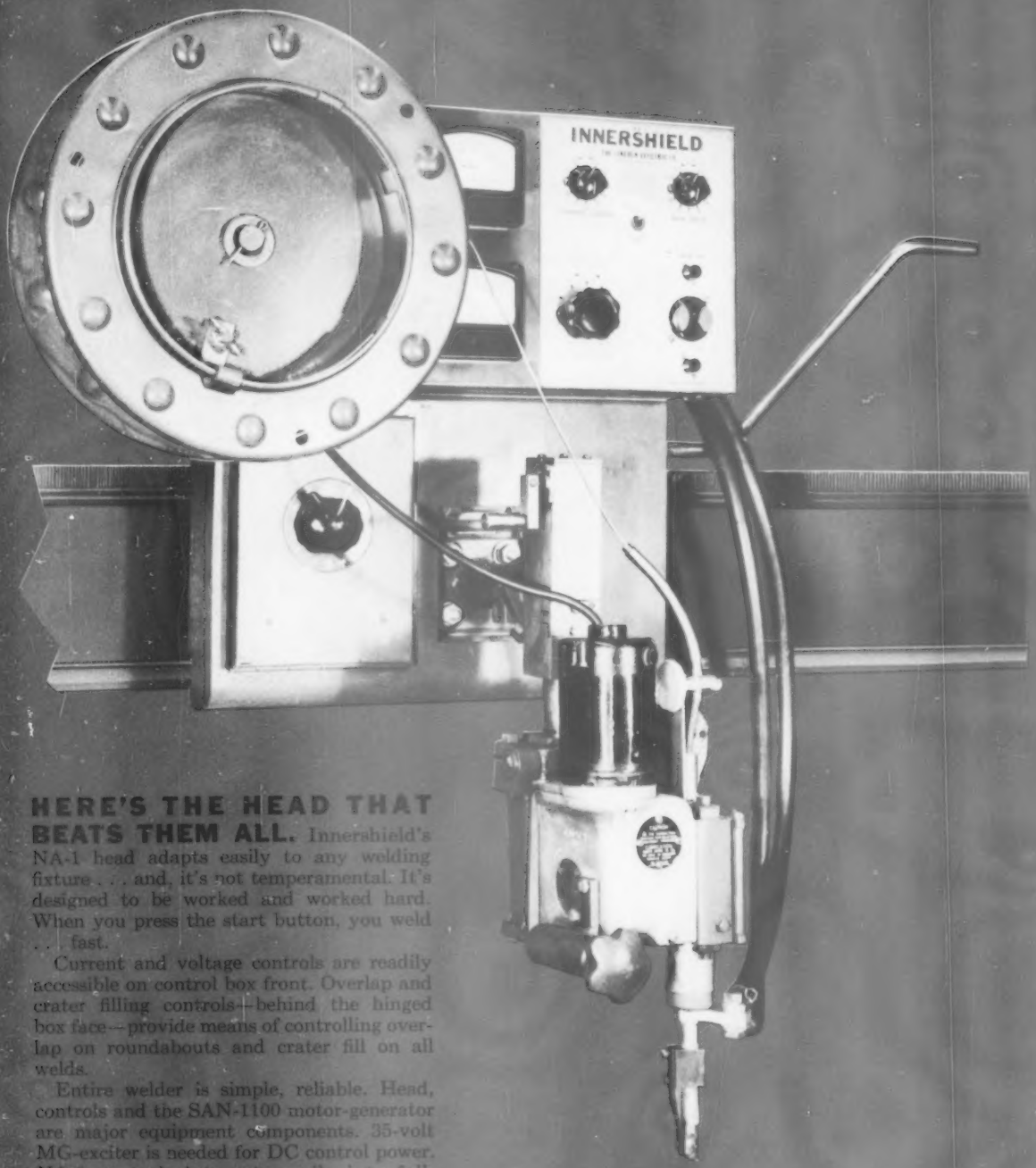
Imagine a welding process so fast it outruns all existing fixtures . . . that exceeds all other automatic processes in fast follow ability . . . that is so practical that it has even replaced manual welding . . . that is lower in installation and operating cost than any other full-automatic process (particularly gas). Such a process exists. It's called Innershield.

Full-automatic Innershield was developed primarily for welding thin materials (down to 16-gage), but it has proved itself equally as capable of making small, high-speed welds on heavier plate.

Obviously, full-automatic Innershield is a natural for knocking out a lot of work—fast. Why not find out more about this hot, new welding process now? See your Lincoln field sales engineer . . . a welding specialist. And ask him for Bulletin No. 5300.1 which describes the Innershield process and its application in both full and semi-automatic equipment. Or write, The Lincoln Electric Company, Cleveland 17, Ohio.

LINCOLN WELDERS

See Innershield demonstrated at our Welding Show Booth



HERE'S THE HEAD THAT BEATS THEM ALL. Innershield's NA-1 head adapts easily to any welding fixture . . . and, it's not temperamental. It's designed to be worked and worked hard. When you press the start button, you weld . . . fast.

Current and voltage controls are readily accessible on control box front. Overlap and crater filling controls—behind the hinged box face—provide means of controlling overlap on roundabouts and crater fill on all welds.

Entire welder is simple, reliable. Head, controls and the SAN-1100 motor-generator are major equipment components. 35-volt MG-exciter is needed for DC control power. NA-1 controls integrate easily into full-automatic fixture controls.

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WELDERS

THE LINCOLN ELECTRIC COMPANY

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THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT AND ELECTRODES

BRAZED STAINLESS BLOCK

continued from page 70

veloped the engine. It was designed by Lloyd Taylor. The engine is called the "Tyce/Taylor."

The developers test prototypes in motorboats. This year they will test other models as powerplants in high-performance Formula I road racers.

BRAZING TECHNIQUES

Ted C. Tyce, vice president, credits Superweld Corp., North Hollywood, for developing brazing techniques that made possible the cylinder block assembly.

The block has many separate parts. An upper valve cover, main case structure, water manifold, five cam bearing webs, and two end plates are stamped from 0.050 Type 302 and 304 stainless. The block head is stamped from 0.090 stainless sheet. Four spark plug tubes are made from stainless sheet. So are the cylinders into which are brazed 0.063 chrome-moly cylinder wall liners.

Before assembly Tyce has all parts flash plated. This copper eventually flows into all the joints during the brazing.

Tyce then tacks the stampings together, using the tungsten inert arc process and resistance spot welding. During assembly, they put four or five ounces of 0.050-inch-diameter pure copper wire along the seams that need the most filler metal.

They ship the assemblies to the Superweld plant for cleaning and trichlorethylene vapor degreasing.

Superweld spreads a copper brazing alloy paste from a squeeze bottle along the exterior of all joints before brazing. Then they put the assembly in a hydrogen atmosphere gas-fired furnace. They hold it at 2,050°F for 20 minutes, allowing the copper flash plating to flow and supplement the copper paste and wire. The blocks stay in the furnace until they cool to room temperature.

Tyce uses a high-strength alloy steel to make cylinder blocks for some engines. These are brazed in a 105-foot conveyorized exothermic atmosphere electric furnace. They are held in the furnace's cooling zone until they cool to 100°F.

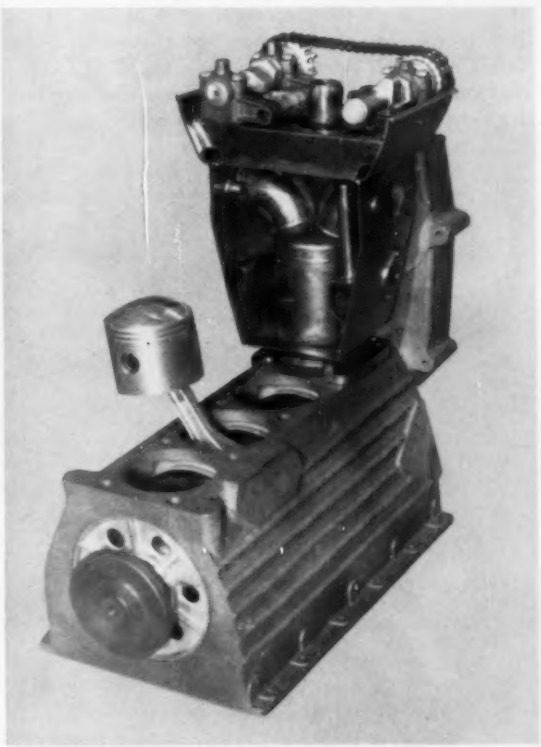
After brazing, the finished blocks are inspected visually and pressure tested. Gaps are filled with copper paste-type alloy and blocks rerun through the furnace. These blocks are reinspected. Leaks are filled with a silver brazing alloy.

The job takes about 10 ounces of brazing alloy. This includes the copper positioned by Tyce during assembly and the additional wire, foil, and paste used by Superweld.

PAINSTAKING ASSEMBLY

Assembly welds are located carefully because lapped edges of the stampings must remain tight during the brazing period. For the same reason, the timing of the heat buildup to brazing temperature must be exact. Experiments established this weld positioning and the timing of brazing sequences.

None of the current models has had seam failures, either in manufacture or in actual use. • •



CROSS-SECTION of block (top) and same cross-section mounted on the crankcase. Photographs courtesy of Tyce Engineering Corp. and Superweld Corp.

← Circle No. 64 on Reader Service Card.

A WELDING SHOW FEATURE REPORT

The plasma arc can now be used for welding and weld surfacing

says **R. M. GAGE,** *Linde Company, Division of Union Carbide Corp.*

IN BRIEF: The plasma arc process had been used only for plating and cutting. New developments now make it possible to use the process for welding and weld surfacing.

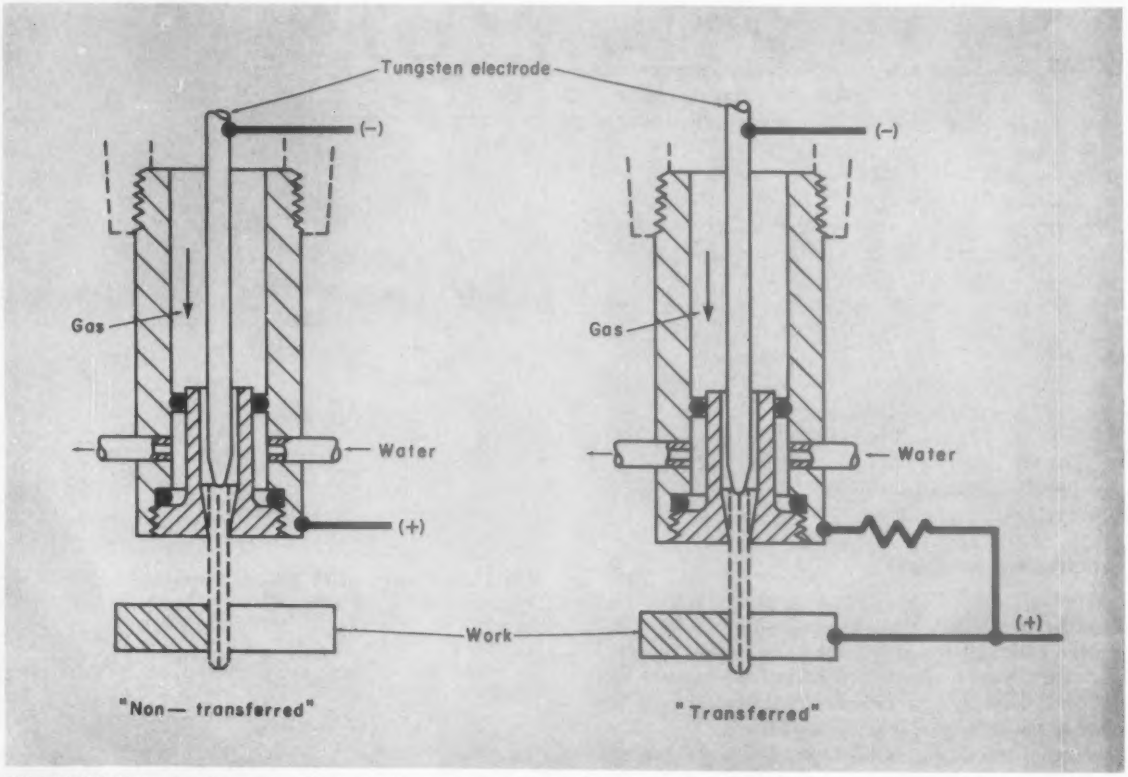
WHENEVER YOU SEE lightning, you see plasma in action. Lightning is an electrical discharge between a cloud and the earth. It changes the air in its luminous path into a highly-conductive ionized gas.

Men have been able to make and study plasma in laboratories since the discovery of the electric arc in 1809. It was only six years ago that a constricted-type plasma arc torch came out on the market. At Linde's Tonawanda Laboratories, we had been studying how arcs behaved when shielded by various rare gases. We saw the flames produced when an arc struck a water-cooled copper anode. After drilling a hole in the anode, we made the arc flame and a flow of gas pass through the anode. This produced a crude plasma arc (or jet).

Later, we added a pilot arc circuit to establish and maintain the arc. We reduced the size of the hole in the copper anode. This formed a nozzle which constricted the arc and the plasma. With minor refinements, the device became the Plasmarc cutting torch. We patented it and put it on the market as Heliarc cutting in 1955.

HEAT TRANSFER

Almost any gas can be used to form the plasma. Non-oxidizing gas is generally used in metalworking torches. The rate at which the gas transfers heat is



DIFFERENCES in electrical connections are shown for nontransferred and transferred arc torches.

more important than the temperature the gas reaches. The higher the thermal conductivity of the gas, the more heat will be transferred. Argon and hydrogen produce arcs of similar temperature range, but hydrogen transfers more heat, because of its higher thermal conductivity.

The plasma arc combines the directional stability of a combustion flame with the high temperature of an electric arc. There are three ways to control the temperature and length of the plasma arc: You can vary the current, vary the flow or composition of the gas, or modify the orifice size. A plasma arc runs from 6000°F to 100,000°F. The hottest combustion flame now available economically is the oxy-acetylene flame with a 6,000°F maximum. You can get plasma arc velocities of thousands of feet per second and you can get flames many feet in length in a power range of a few watts to many megawatts.

TRANSFERRED VS. NONTRANSFERRED

There are two types of constricted plasma-arc torches, transferred-arc and nontransferred-arc. We hold a basic patent position on both. They differ physically in the electrical connections. In the transferred-arc torch, both the arc and the stream leave the nozzle. The work piece is an electrode in the circuit. In the nontransferred-arc torch, the nozzle itself is an electrode. The arc ends at the nozzle; only the hot discharged stream reaches the work piece.

The transferred-arc torch can transfer more heat and do it more efficiently than the nontransferred-arc. Metalworkers use it mainly for welding and cutting, which call for melting the work piece, and for surfacing applications which require fusing the surfacing material to the base metal.

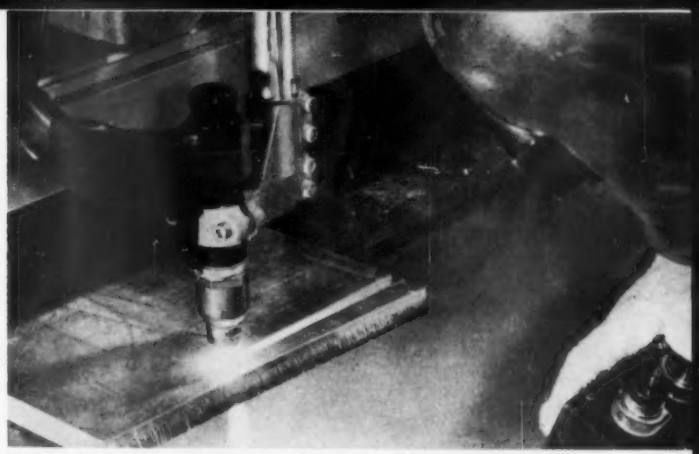
The nontransferred-arc torch can concentrate its heat inside the torch. Its greatest use is for plating. The plating material is heated to a plastic or molten state inside the torch and blasted onto the work piece. The nontransferred-arc torch has a variety of others uses: To melt ceramic materials and simulate atmospheric re-entry conditions; in studies of nonpropulsion engines, high-temperature chemical reactions and refractory crystal growth, as a source of high-intensity light, and as a heat source for extractive metallurgy and high-temperature machining.

PLATING

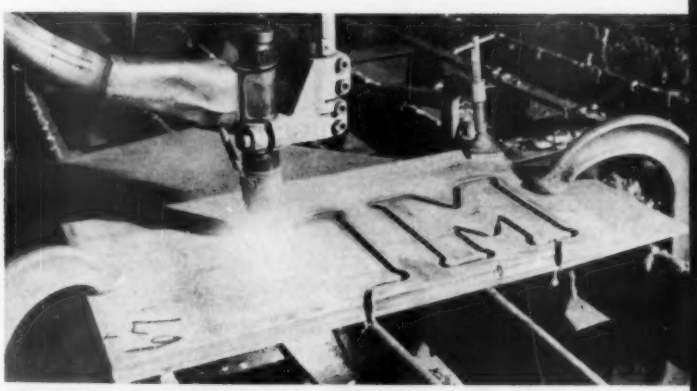
The nontransferred-arc torch is important in applying platings of refractory materials, particularly to parts for missiles and rockets. Metallic and non-metallic materials and even certain reinforced plastics can be coated. The coating material can be almost any inorganic solid that can be melted without decomposing. Coatings can be made any thickness, by depositing layer on layer. There is no sacrifice of mechanical strength. Coatings successfully used so far: Tungsten, tantalum, molybdenum, nickel, platinum, aluminum, alumina, and zirconia. We offer Plasma-Plating only as a service.

Plasma-Plating coats tungsten on graphite for rocket nozzles. Plasma-Plating also serves in the fabrication of tungsten parts by applying successive coatings to a mandrel, which is later removed. The tungsten parts and coatings, as-coated, have densities up to 90

continued on page 78

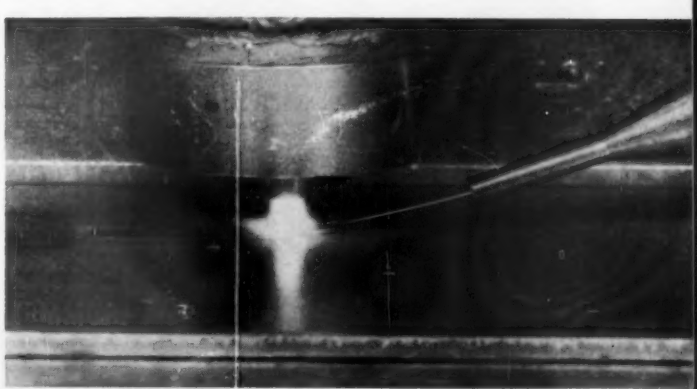


MECHANIZED CUTTING 1-inch-thick aluminum.



MECHANIZED CUTTING 1-inch-thick stainless.

WELD SURFACING, applying Stellite 157-M alloy to periphery of 1/8-inch-thick by 4-inch-diameter disc.



WELDING STAINLESS, adding filler rod.

PLASMA ARC WELDING

continued from page 77

percent of theoretical, a modulus of rupture of 50,000 psi, and a Young's modulus of 24 x 10^6 psi. All of these can be improved substantially by heat treatment. A finer surface finish may be obtained by standard equipment and methods of grinding, lapping, or polishing the coatings.

CUTTING

We introduced Plasmarc cutting in 1955 for use on aluminum up to 1½-inches-thick. It was soon used to cut magnesium, stainless, copper, and nickel. Cuts up to 1½-inch are dross-free. The wall of the cut has little or no concavity, eliminating most preweld preparation.

Recent research makes it possible to cut aluminum up to 5 inches thick, stainless and other metals up to 4 inches thick.

We have also aimed considerable research at carbon steel. Plasmarc cutting is faster than oxygen cutting on rip-cutting and vertical straight-line finish cutting. Quality of finish cuts is often satisfactory. It is definitely not equal to high-quality oxygen cuts. This difference is even greater on shape cutting which requires a straight vertical cutting line. We manufacture equipment for both processes and are continuing comparative studies on carbon steel.

Plasma cutting can reach speeds over 1,000 ipm, far beyond practical requirements. Most metal cutting is done between 10 and 300 ipm. Mechanical cutting usually is incomparably slower and costlier. Plasmarc cutting slices thick metals in seconds that would require hours to saw. It holds tolerances as close as 1/16 inch. It is so fast and well-shielded that only a 0.040-inch heat band forms on the kerf edge. This is easily washed out during welding.

The cutting equipment is compact, can be used manually or automatically. Over 1,000 plants use Plasmarc cutting. This is the largest single industrial use of plasma arc.

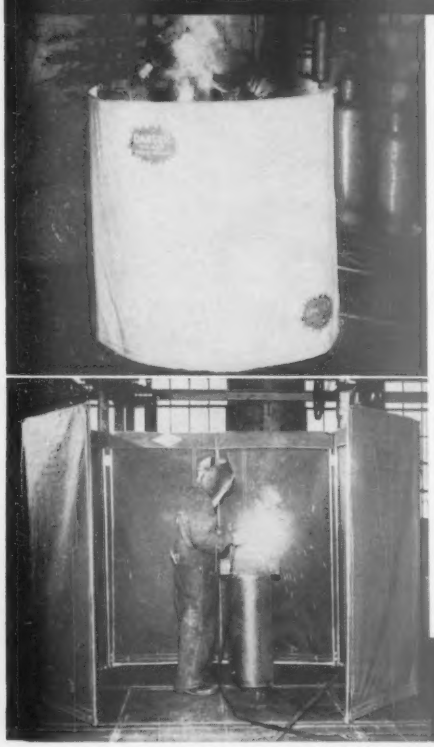
ABOUT THE AUTHOR: Mr. Gage is assistant manager of Electric Welding Development at Linde's Newark Laboratory. He joined Linde in 1946 at Tonawanda Research Laboratory where he supervised development work on the plasma arc, on which he holds basic patents. In 1956 he was appointed assistant manager of research at Linde Speedway Laboratory where he worked on high temperature processes using arcs and flames.

WELD SURFACING

Plasma arc weld surfacing is the first process to deposit a very thin fused coating with controlled dilution at high speeds. The deposit is a true weld fused to the work piece. It resists impact and high stresses. It is

continued on page 80

SHIELDING FOR SAFETY



SPA-FLA PORTABLE WRAP-AROUND SHIELD WITH BUILT-IN HANDY HANGER

ROLLS UP

The recognized standard in safety shields. SPA-FLA has a 14-gauge galvanized wire insert that permits it to be shaped around the job for maximum floor level protection. It's self standing, readily portable, rolls up compactly. Ideal for welding, cutting, grinding . . . wherever a quick, safe screen is required. "D" rings at all four corners for supporting on overhead operations. Select from 15-oz. UL Approved Duck, or the modern, Fire-resistant WELD-TEX vinyl-coated glass cloth fabric. Seven standard sizes from 18" x 30" to 72" x 108".

SAF-T-SCREEN ALL-PURPOSE SCREEN, ROOM DIVIDER, ENCLOSURE

FOLDS UP

Need a quick, inexpensive room partition, wind break, work shelter, or protective screen? Then here's your answer! Saf-T-Screen is a rugged, tubular Aluminum frame, sturdily hinged in multiple sections to form a self-standing, floor-level screen or partition with a hundred uses. It folds compactly, is easily carried. Fabrics include choice of UL Approved Duck, WELD-TEX vinyl-coated glass cloth, or RAY-FOIL for radiant heat protection. Panel sizes are 36" x 72" or 36" x 60". Casters are available. Special sizes can be custom-built to order.

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At New York Welding Show.

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FABRICATORS OF APPROVED SAFETY PRODUCTS

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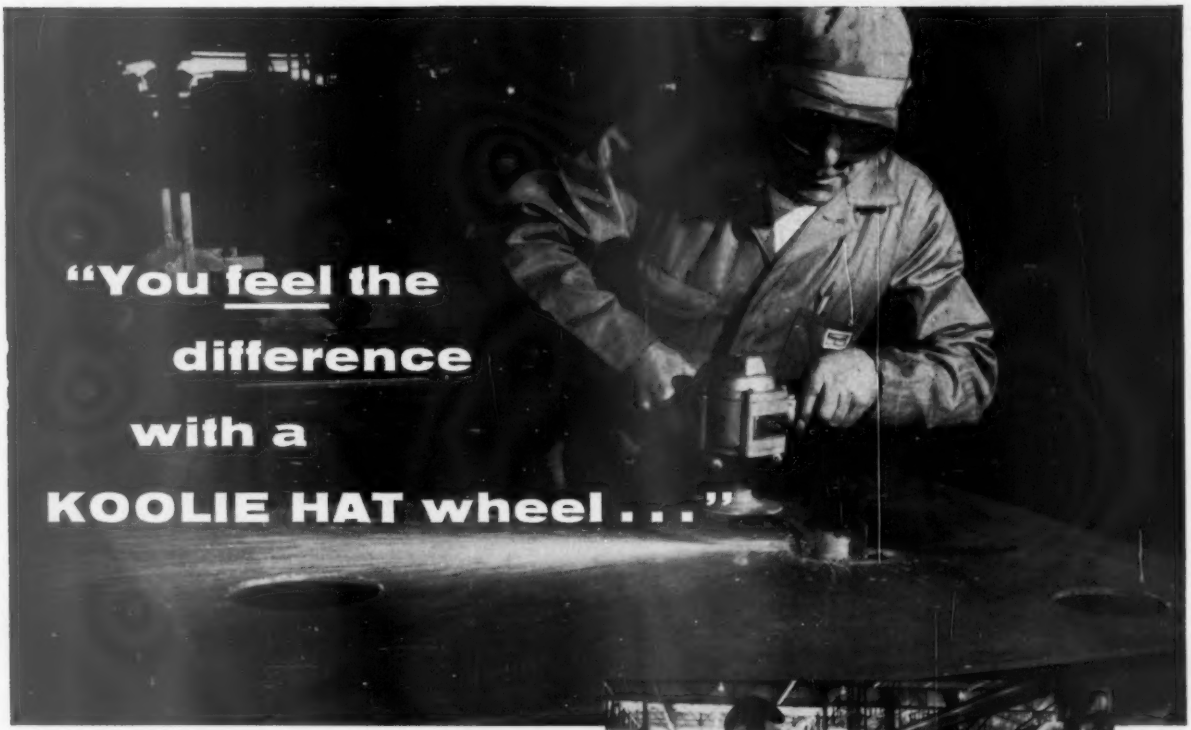

"I can work almost half again as long without getting an ache in the wrist and arm muscles," says Walt Via (shown above grinding a Utility Trailer king-pin assembly).

"... even after a long stretch of grinding, I'm not tired. Its unusual shape makes grinding hard-to-get-at spots easy." That's what Operator Walter Via says about the Koolie Hat wheels he's been using at Utility Trailer Manufacturing Company, Los Angeles, one of the West Coast's biggest manufacturers of custom-built trailers.

Here's *why* Bay State's unique reinforced resinoid disc-wheel is the least fatiguing, fastest, safest wheel on the market:

Easier Operation "Koolie Hat" wheel is held at 4° to 5° angle instead of 25° to 30°, requires less pressure, virtually eliminates jitter and bounce.

Extra Safety "Koolie Hat" shape wears evenly over all three abrasive layers instead of one at a time. Less danger of shattering due to heat cracks or thinning of wheel.

More Uniform Speed Narrow radial contact surface between "Koolie Hat" wheel and surface keeps speed high for fast, efficient metal removal without heat build-up.

If you want to give your operators (*and* your profit curve) these advantages, get the full story from your Bay State distributor or direct factory representative. *Better grinding at lower cost, that is their business.*

See KOOLIE HAT in Booth 501 at American Welding Society Exposition

Bay State representative Emil F. Rogers (left) shows the unique shape of the Koolie Hat wheel to Utility Trailer's Director of Purchasing, Virgil D. Waters (right) and Lead Operator Walter Via (center).

NEW U-grade formulation complements original "Koolie Hat" R-grade wheel, ensures extra-long life when grinding all materials with higher speed grinders operating at 5200 r.p.m. or above.

BAY STATE
WHEELS of PROGRESS

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
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Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

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AUTOMATIC FORK LIFT SAFETY LOCK ATTACHMENT

Transforms any fork lift truck into a safe, efficient mobile overhead lifting unit.

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PLASMA ARC WELDING

continued from page 78

free of porosity. The operator can control the dilution of the deposit in a range of from 5 to 50 percent.

Plasmarc surfacing can produce weld overlays 0.010 inch thick and greater from a variety of metal powders. By tailoring the powder formulations we have deposited successfully nickel, copper, and cobalt-base alloys, stainless, materials containing chrome-carbide, and heterogeneous materials such as tungsten carbide particles in a steel base.

WELDING

Plasmarc welding has a stability and ease-of-control which make it outstanding. It has no products of combustion. More important, its higher voltages, power and energy-transfer produce uniformly penetrated, high-quality welds.

As the torch moves along the path of the pieces to be joined, it melts a seam which cools and solidifies within the inert-gas shield. The weld has an extremely good penetration-to-width ratio and shows little variance in dimensions over a wide range of torch elevations. Excellent depth control forms a uniform underbead on stainless steel and aluminum without backing. It can flange weld sheet metal at a rapid rate with good results. Speeds are comparable to Mig and Tig welding. The absolute arc stability and uniform penetration permit close tolerances which make the process ideal for automated welding. • •

Ranite HARD SURFACING ELECTRODES

ARE PREFERRED FOR:

FAST DEPOSITION RATE
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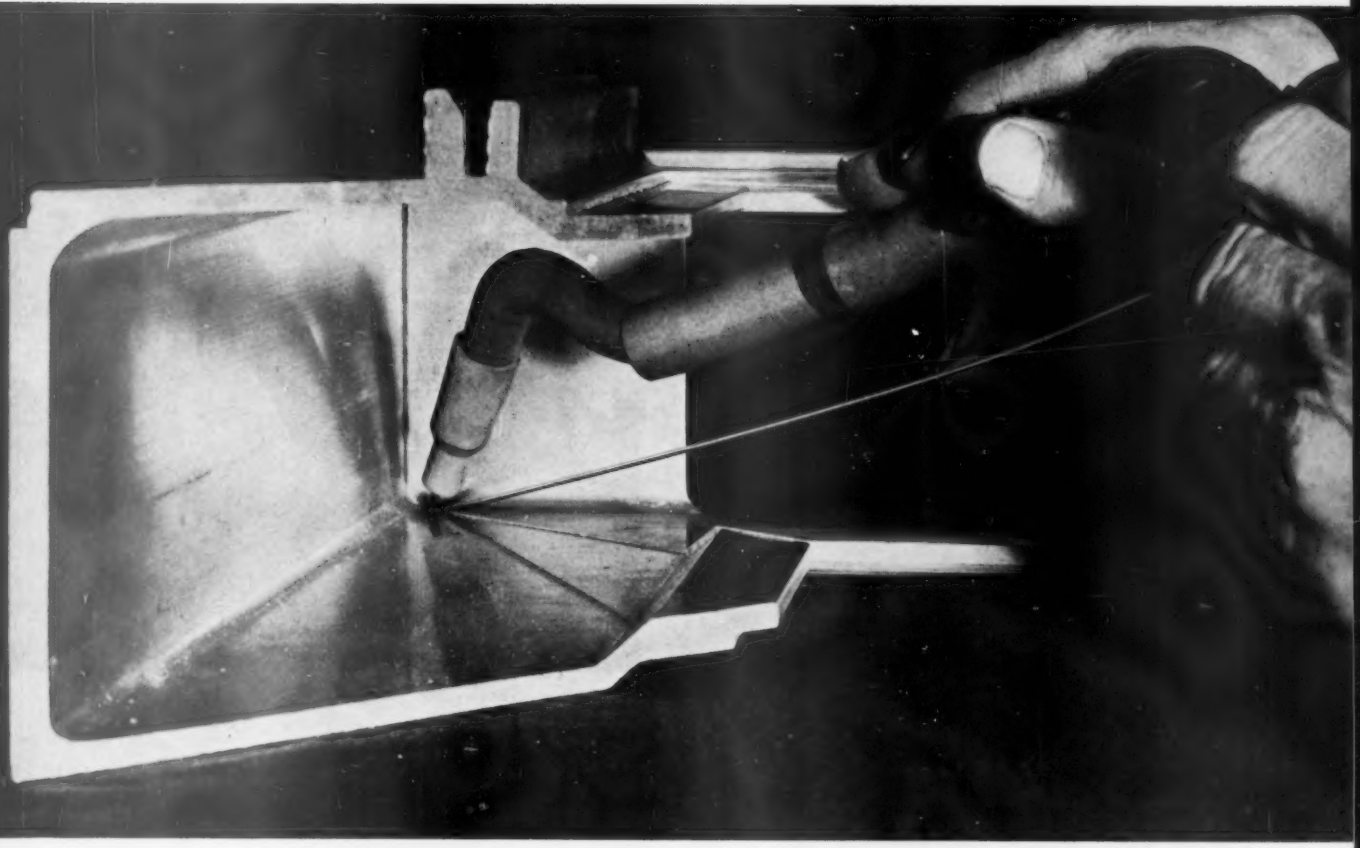
WELDING SHOW

ONE TORCH DOES IT ALL!

YOU set the angle to suit the work!

Complete flexibility is yours with the FALSTROM Controlled Angle Torch



Here is a completely NEW torch for tungsten inert gas, arc welding . . . a torch you can hand adjust to any angle or extend to reach hidden recesses. The Falstrom Controlled Angle Torch assures you of the RIGHT ANGLE FOR EVERY JOB because you set the angle to suit your preference. *No lost time* changing torches. *No awkward positioning* to make the wrong angled torch do the job. The Falstrom torch means *low inventory* and *low maintenance* and this means *low cost* to the user. One torch does it all.

Model WC-180, illustrated above, is water cooled, rated at 180 amperes continuous duty, 300 amperes intermittent duty. Three different hose lengths are available with this torch — 12½ ft., 25 ft., and 50 ft. Write or call today for your free copy of our new catalog WC-60.

FALSTROM COMPANY 222 FALSTROM COURT, PASSAIC, NEW JERSEY PRescott 7-0013

WC/601 A

A WELDING SHOW FEATURE REPORT

this electronic scanner tells 24 welding machines when to make more than 860 spot welds in rail and floor pan assemblies for Chrysler Corporation cars

Electronic brain controls welding of unitized bodies

LADDER assemblies speed along the line.

IN BRIEF: Electronic scanner makes sure no two welding machines fire at the same time. It also makes sure each welding machine gets the same amount of current each time it welds.

"ARE YOU READY TO WELD?"

That's the question an electronic scanner asks 24 resistance welding machines 320 times a second.

The place is Chrysler Corporation's stamping plant in Twinsburg, Ohio.

The scanner is called the Magic Wand. It's the only one of its kind in the world. Its pulses travel from one welding machine to another, automatically searching, controlling, regulating, timing, and recording on the automobile industry's largest automatic welding line.

When the scanner gets satisfactory answers to its questions, it permits individual firing of the 24 units, They fire so fast you can't detect the intervals. These machines make more than 860 spot welds in the rails and the floor pan assemblies for almost all Chrysler Corporation cars.

WHO NEEDS IT?

The Magic Wand belongs on Chrysler's automated assembly line because welding calls for tremendous amounts of electrical power. Two giant welders firing simultaneously would cause excessive voltage drop, seriously reduce weld quality.

THE SOLUTION

This scanner keeps the machines from firing at the same time. The Magic Wand controls the firing in milliseconds. Its pulses travel from one machine to

HOW CHRYSLER WELDS UNITIZED BODIES

The 658 foot line is the largest in the industry used for making unitized bodies. At the extreme tip of a T-shaped line, sheet steel is welded into inner and outer rails and becomes a ladder assembly. At the other tip of the T, center floor pans and rear floor pans are welded together before they reach the center of the T.

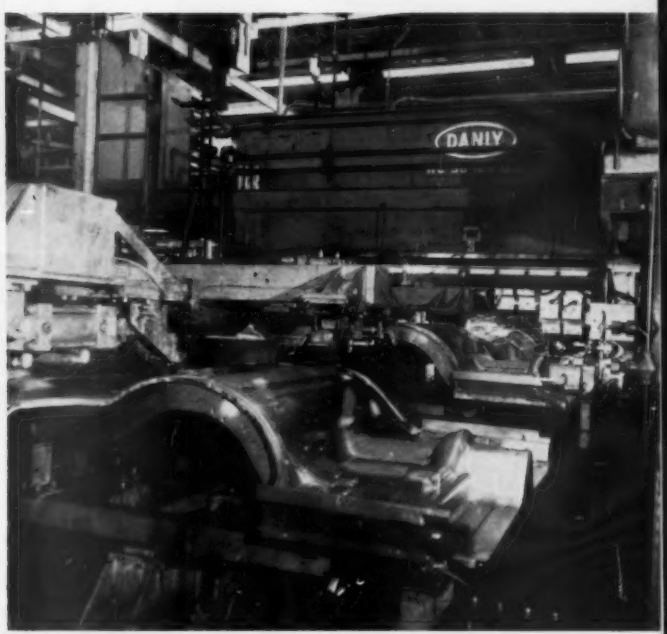
The ladder assemblies and the floor pan assemblies meet at the center and turn into a straight line. They are joined when they go through a number of giant welding machines. There are 80 resistance welding operations. These are done on machines ranging from 100 up to 2,400 kva.

The ladders and the pans travel at astounding speed on large shuttles. These move the assemblies from one welding machine to another.

During welding, structural crossmembers are welded to the floor pan and ladder assemblies. As a shuttle arrives at the welder, the part rises mechanically to meet the electrodes. Electronic timers watch every move. For instance, a squeeze timer gives ample time for the metals to be squeezed together. Another timer holds the parts under pressure until molten metal solidifies.

These lines turn out more than 2,000 complete assemblies in an 8-hour shift. The line can be changed to handle a new shape in only 20 minutes. The line can handle seven different car pan shapes. New car configurations can be adapted to the line in single 8-hour shift.

FLOOR PAN assemblies are welded here.



THE TWO assemblies are joined and ready to ship.

another at a rate of 120 millionth of a second.

The scanner also makes sure each welding machine gets the same charge of electricity each time it welds. This helps to produce consistent welds.

It directs 90,000 kilovolt amperes of energy, which is the electrical demand of all 24 machines. This is equal to 45,000 watts or 60,000 hp.

THE MAGIC WAND IS IMPATIENT

In an automated assembly line certain machines react quicker than others. The Magic Wand is an impatient scanner. It turns on a red warning light and moves on to fire other welding machines if a given machine fails to fire and send in its finish signal in three seconds. If the shop can't fix any part of the automated line in a few minutes, the entire assembly is shifted to a duplicate line. This has the same number of welding machines and the same electronic brain to command it.

ALWAYS BE PREPARED

What happens with the Magic Wand blows a tube and stops? You guessed it! There is an identical interlocking scanner alongside that can be connected in 15 seconds.

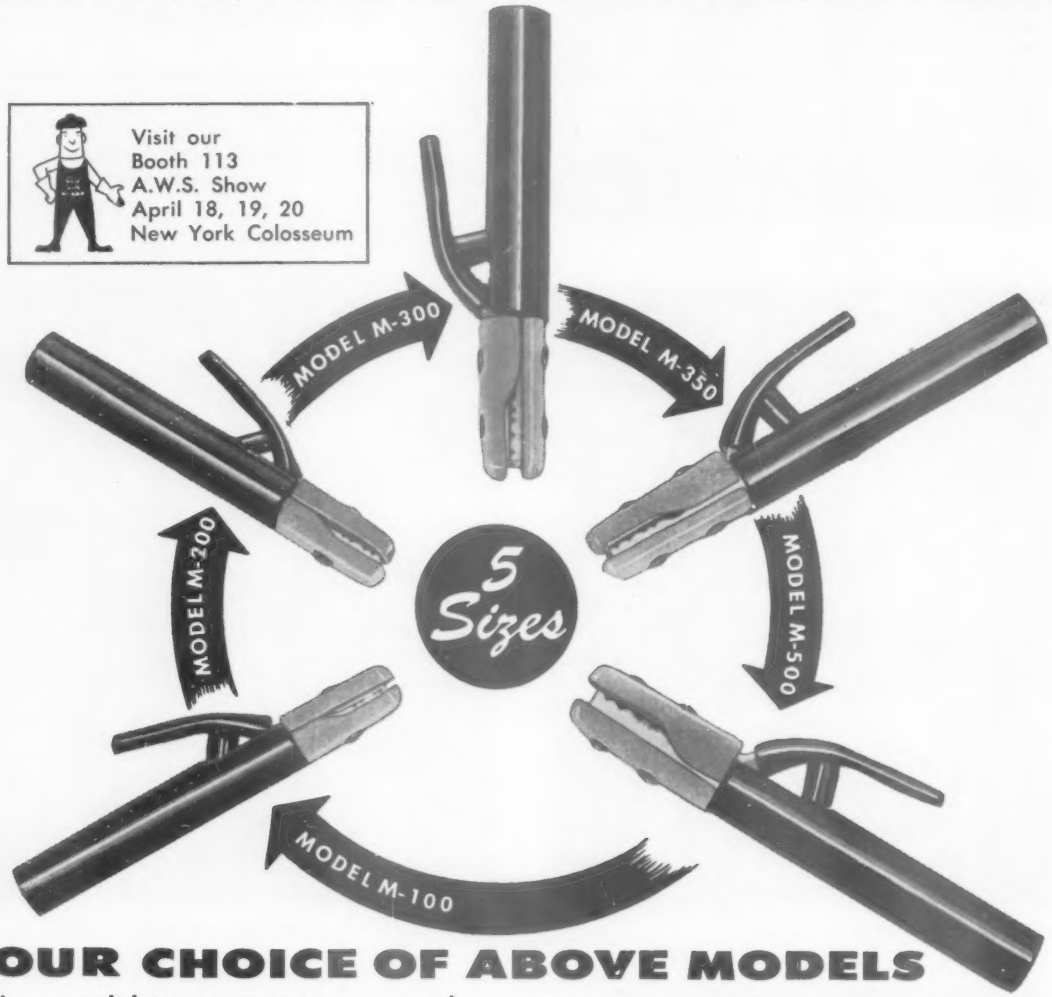
WHAT ELSE DO YOU NEED?

Chrysler owns and operates its own outdoor substation. This steps down power from 132,000 volts to 13,200 volts. Power is distributed through tunnels to various substations through the plant. There are 3½ miles of armored coaxial cable and conductor cable feeding the power to the assembly lines. There are more than 10 miles of control wires in the operation.

• •

HI-AMP Economy Series

ELECTRODE HOLDERS



YOUR CHOICE OF ABOVE MODELS

With a model to serve every manual arc welding purpose. Tong members made from high copper alloy with ample cross-section to handle rated currents.

This "M" series of electrode holders is made to forget about maintenance problems. Buy them, make proper connections to your cable and obtain long, durable life. Instead of spending time and money on repairs, replace with new holders after many hours of good, cool running service.

Pick the size required for your plant operations and order the ones you need, today.

Model No.	Amperage	Cable size	Electrode size	Weight
M-100	100	#1	1/8"	10 ounces
M-200	200	1/0	5/32"	11 ounces
M-300	300	1/0 & 2/0	1/4"	19 ounces
M-350	350	1/0 & 2/0	5/16"	21 ounces
M-500	500	3/0 & 4/0	3/8"	27 ounces

Manufactured By

LENCO, INC.

350 W. ADAMS ST. JACKSON, MISSOURI

SOLD THROUGH LEADING WELDING SUPPLY HOUSES

For More Information Circle No. 61 on Reader Service Card.

A WELDING SHOW FEATURE REPORT

SURGERY? No, but this huge steam reducing valve is almost ready for the welding operation. It's being induction preheated to the right alloy welding temperature. Induction cables, wrapped around each side of the joint, will heat the whole weld area, won't have to be moved for stress relieving after welding.

Designers! Don't overlook on-the-job stress relieving

says **OTTO KREISEL**, *chief engineer, Electric Arc, Inc.*

IN BRIEF: Preheating and stress relieving have assumed a new importance since high-carbon and alloy steel weldments are going to work in high heats and pressures. This article tells how to heat weldments economically.

IN FABRICATION, does the designer consider steps like welding sequence, assembly, and heat treatment, or does he leave them for the fabricator to figure out? Too often the fabricator gets the job, and it puts him —and the product—at a disadvantage.

If the weldment is of alloy steel or has thick walls to hold high pressures and temperatures, preheating and stress relieving are important. Examples are piping systems, heat exchangers, and nuclear power equipment. Heat treatment is not only important to these products, codes and specifications usually require it. But frequently, heat treatment, like a plugged sink, isn't worried about until it happens.

HEAT TREATING COSTS TOO

You may be in for a shock if you don't plan for heat treating; the cost can run away with the profits. Here's why:

It costs between $100 and $500 a weld to preheat and stress relieve a 12-inch pipe with a 1-inch-or-over wall. Why so high? The usual causes are inexperience, poor supervision, and too many people.

You avoid high heat-treating costs by training. An it can be done in less time than you think: In three or four days, operators and supervisors can get all the instruction they need from suppliers for successful, economical operation.

But it's the designer who controls heat-treating costs. If he knows the latest stress-relieving techniques, how to properly heat the various alloy steels, and how to avoid stress concentrations, he'll do a good job. If he doesn't know these things, chances are he's overpaid.

Once the charcoal furnace, the gas torch, and the clamp-on muffle furnace were good enough. But nowadays alloys need high heat and precise control—something the old methods were unable to give. Another thing, many of the new weldments are too large for a heat treat furnace; and many a pipe job has to be heat treated in the field.

So they heat treat weldments two ways: electrical resistance or induction.

Resistance heating uses ceramic-bead covered,

continued on next page

GUIDES TO STEEL HEATING

- **Stress relieve** carbon, carbon-moly, and chrome-moly (4-6 Cr) steels at 1,100 to 1,375 F., depending on the alloy and stabilizing contents.
- **Stress relieve** the 10 to 14 Chrome steels from 1,450 to 1,650 F.
- **Solution treat** the austenitic stainless steels between 1,850 and 2,000 F.
- **Holding time** is determined by the thickness of the weldment; it ranges from one to two hours per wall inch.
- **Heating and cooling rates:** heating, 100 to 400 F. per hour; cooling, 150 to 300 F. per hour. Shape, wall, and mass affect the rate.
- **Ductility,** the goal of stress relieving, is determined by hardness tests.

Note: Each steel has its own specific characteristics; it is important that welding procedures and stress relieving are considered from data specified by code or by the steel producer.

THESE CODES COVER THERMAL TREATMENT OF WELDS

Knowlege of code requirements for proper heating of alloy steels can help reduce the cost of heat treatment. The designer, especially should be familiar with the sections of these codes that pertain to the preheating and postheating of welds. If the heat treatment of an alloy is uncertain, or the code needs interpretation, call in a credited metallurgist.

American Society of Mechanical Engineers—Unfired Pressure Vessels, 1956 Edition.
Section VIII, paragraphs UCS-56, pp. 77, 78.

American Standards Assn.—Code for Pressure Piping, ASA B 31.1-1955, UDC-621.64.-002. 1/.2; published by ASME.
Chapter IV, Welding of Pipe Joints, paragraph 632 A to D, pp. 99, 100.

American Society of Mechanical Engineers—ASME Boiler Construction Code, 1946 Ed.
Paragraph 268, sections P, Q, R, S, p. 114.

Navy Dept., Bureau of Ships—MIL STD.-278 (Ships), dated 19 Sept 1956.
Paragraph 5, Materials; subparagraphs 5.1.2 and 5.2.3, p. 5; subparagraph 5.3.2, p. 6; subparagraph 5.4.3, p. 7; subparagraphs 5.6.3 and 5.7.2, p. 8; subparagraphs 5.8.3 and 5.9.3, p. 9.

United States Coast Guard—Marine Engineering Regulations & Material Specifications, CG-115, 12 Nov 1952.
Item 56.01-70, p. 1119

American Welding Society—Recommended Practice for interruption of heat treatment for low chromium and molybdenum steel piping materials, D-10.3-55T (tentative).

STRESS RELIEVING *continued from page 85*

thin-wire heating element coils connected to the 220/440-volt power line with contactors. Usually pyrometer controllers regulate the heat. First, the heat treaters attach thermocouples to the weldment. Then they wrap the heating element around it. Finally, they wrap heat-holding insulation around the element.

Heating depends on the length of the element, the current, and the on-off time. Rate controllers usually regulate on-off time.

Resistance heating is effective and can be closely controlled—but it has certain drawbacks. The worst: heating elements burn out—usually when the heat is highest. When the element goes, the job has to be wrapped and heated all over again. And a burnout is a serious hazard to the operator. If the loose end of the element touches the pipe you've got HIGH VOLTAGE! Also, the hot end can score the pipe.

Elements fail because of hot spots. Adding more current to these already overloaded areas melts the wire.

HOTTER JOBS, NEW METHODS

They used to stress relieve carbon-moly steels between 1,150 and 1,250 F. The newer chrome-moly alloys, however, require 1,300 to 1,400 F, and the higher chromes, as much as 1,550 F. These heats burn out heating elements even faster. So they developed low-cycle induction heating.

Induction heating uses copper cable, not resistance wire. The weldment is insulated with asbestos sheeting and wrapped with the cable. Current induces an alternating magnetic field that acts on the pipe. The high-resistance, current-carrying pipe acts like a short-circuited secondary of a transformer. The short-circuited current heats the pipe and the insulation prevents the heat's escaping.

With induction heating, you can raise heat either with more cable turns or with more current—and there's much less danger of conductor burnout than with resistance heating.

When you heat pipe of nonmagnetic stainless steel or magnetic steel above the magnetic point (1,400 F.) eddy currents do most of the work. In magnetic metals about 4 percent of the heating is through molecular friction from alternate magnetizing and demagnetizing.

In induction heating, voltage is kept low (safe) with high currents. On large weldments, voltages seldom exceed 100. Currents from 500 to 1,000 amps at 60 cycles and 400 to 800 amps at 400 cycles are generally used.

Low voltage is important for another reason: Asbestos or glass insulation won't stop high voltage if they overheat.

A disadvantage of induction heating is that the kw input in the weldment is only half of the kva of the equipment. If the weldment is hotter than 1,400°F. (the magnetic point), the power conversion is even lower—30 percent. Resistance heating uses all the input.

INDUCTION HEATING EQUIPMENT

In induction heating, the simplest, most rugged equipment is the transformer type, which also regulates and programs. You can put the transformer anywhere or get a portable model for the field.

If you need frequencies in the 400-cycle range, you can use motor-generator equipment. It's more expensive, less rugged than the transformer, but useful where power is limited and where thin-wall weldments are to be heated above 1,600°F.

Taps regulate current and voltage in transformer equipment. Contactor interrupters permit use of on-off controls for regulating heating, holding, and cooling.

Heat sensing equipment includes pyrometers and pyrometer controllers. These instruments, usually potentiometers, have iron-constantin or chromel-alumel thermocouples. They require no calibrated leads between thermocouples and recorder. On portable equipment, the newer, faster-acting, more rugged electronic recorder-controllers are best.

You can control heat with simple on-off controls and equipment settings, or control it manually with an on-off switch. The ultimate in control, however is fully automatic heating, holding, and cooling. Another system uses proportioning controls: demand controls heating.

GUIDES TO GOOD INDUCTION HEATING

■ It takes 12,000 ampere-turns at 60 cycles, or 6,400 ampere-turns at 400 cycles to heat 4-inch band on a weldment. More turns take less current but higher voltage.

■ Choose a heating coil conductor that will carry the current you use.

Don't worry about heat loss when you shut off induction current to weld; the heat will recover quickly when you turn on the juice during weld cleaning.

■ Give your operator welding room by putting the induction coils on either side of the weld. They will properly preheat *and* stress relieve the metal between them without moving them.

■ Good heat control depends on putting the right number of thermocouples in the right places. No matter how expensive or complicated your instrument, it will only indicate heat where the thermocouple contacts the weldment. If the heating system your using isn't reliable, improperly located thermocouples won't tell it—and the weldment will still have stresses.

■ One thermocouple on a weldment isn't enough. Three—one on the weld and one on each heated zone (1 to 3 inches from the weld) is minimum insurance that you're getting the right heat-band width.

■ Codes require that pipe heat bands be at least twice the width of the weld. For pressure vessels, the heat band must be six times the plate thickness on each side of the weld.

■ When you heat with resistance, insulate the thermocouples. Otherwise, the red hot heating elements will distort your readings.

■ Use the smallest possible thermocouples with induction heating; keep them tightly against the work. If they're away from it, you'll get low readings. • •

PORTABLE PRECISION IN ULTRASONIC WELD INSPECTION

THE NEW BRANSON SONORAY® MODEL 5

for inspection of raw materials going into weldments, as well as of the finished weld itself, goes with you to the job wherever it may be . . . brings laboratory precision into the field and permits the most accurate evaluations of internal structure possible today. Simplified controls, easily mastered by non-technical personnel, are centralized on the front panel. Skilled service by factory-trained specialists is always available across the nation.

PORTABLE: Weighs only 37 pounds complete.

SENSITIVE: Detects **all** cracks; instrument response adjustable to suit exact quality requirements of any job.

PRECISE: Completely locates, and determines extent of, internal discontinuities.

ECONOMICAL: Costs **$2750.**

•

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72 BROWN HOUSE ROAD • STAMFORD • CONN.

For More Information Circle No. 24 on Reader Service Card.

A WELDING SHOW FEATURE REPORT

the building . . .

the welding . . .

CO_2 Welding: A stronger, lighter building

IN BRIEF: The CO_2 process requires fewer passes and less weld metal; it makes welded joints that are strong enough to resist dead-, live-, and wind-loading.

WELDING SIMPLIFIED the fabrication of structural steel column sections and cantilever framing for the multi-story American National Bank Building in Beaumont, Texas. It gave the architects, Harrell and Hamilton, Dallas, freedom in design, producing joints strong enough to resist dead-, live-, and wind-loads.

John Dollinger, Jr., of Beaumont fillet welded stiffener plates and connection to 14 inch ASTM-A7 wide flange columns. They welded these fittings in the shop and assemblies in the field, using Arcosarc CO_2 equipment, consisting of wire drive unit, hand gun, CO_2 shielding gas, and flux-cored wire. It uses conventional power sources with current ranging from 350 to 550 amps. This high current increases burn-off rate and travel speed.

The process has a visible arc and gives deep penetration. This enables a skillful operator to compensate for poor fit-up. This deep penetration also does several other things: It produces strong fillet welds with fewer passes and less weld metal, it eliminates edge preparation when making butt welds in thinner plates, and it permits using smaller joint openings in metals thicker than ½ inch, again reducing the amount of weld metal and the number of passes.

Continuous wire feeding cuts welding time by eliminating unproductive stop-start interruptions. It also eliminates stub loss encountered when welding manually with coated electrodes. • •

AEROSPACE FORECAST

continued from page 47

• High impact welding with explosive and spark discharge pulse apparatus will be developed.

AUTOMATION AND BUILT-IN SENSING DEVICES

The need for precision and quality control in welding high-temperature high-strength materials will call for increased automation (mechanized and numerically-controlled) and for equipment with built-in sensing devices that will even determine weld quality while the weld is being made.

BRAZING

The AIA says brazing fixtures for large-area parts and panels will have to be able to operate continually at 3,500°F.

These are other trends and needs:

• Self-heating brazing fixtures for specific part series will probably replace large furnaces.

• New-type furnaces will be necessary to braze ceramics, cermets, glass, and refractory metals.

• Equipment with minimum tooling and furnace brick heat will be developed to heat only the assembly to brazing temperature. This will permit developing techniques for quick heating of assemblies while reducing contamination and solubility erosion.

• Contoured panels will require non-expandable fixtures that will give rigid support, close tolerances, uniform heating, and a minimum of deformation during heating cycles. • •

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when it MELTS you know the *temperature!*

NEW *Markal* THERMOMELT TEMPERATURE INDICATORS

With Handy Adjustable Holder

The easy modern way to determine exact working temperatures!

Just mark or stroke the surface with THERMOMELT . . . when it reaches the desired temperature, the mark liquefies. There's no guesswork, no wasted time or material . . . THERMOMELT is the quick, precise way to determine heating temperatures. Accurate to within ±1%.

A Stik For Every Temperature from 113° F. to 2000° F.

SEND TODAY for free THERMOMELT literature and pellet sample (indicate temperature desired).

ALSO AVAILABLE IN LIQUIDS AND PELLETS for inaccessible or hard-to-measure applications. Wide range of temperatures.

Made by the Manufacturers of Markal Paintstik Markers and Protective Coatings.

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For More Information Circle No. 46 on Reader Service Card.

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PRESSURE TYPE
PORTABLE SANDBLASTER

NEW Model 28A
Small • Compact
Completely Portable

For use throughout the welding and metal fabricating industry where fast, economical sandblasting is necessary. Quickly removes corrosion, paint, scale, welding flux, etc. Inexpensive to operate —requires no more air than a production spray gun . . . Quality constructed of ⅛ inch steel . . . only 29 inches high . . . easily carried from job to job.

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HANDI-BLAST DIVISION
Hamill Manufacturing Co., Inc.
Dept. J, Washington, Mich.

CUT BEVELING TIME BY 85% on Small Weldments

PULLMAX BEVELLER

The PULLMAX Beveller can be used to bevel cut large size plates with proper table support and feeding arrangement. But where the PULLMAX Beveller really pays off is in small segments difficult to bevel cut by burning and grinding.

Bevel small plate in both straight and mild radius shapes at speeds up to 11 ft. per min.

			A	B
A	1 Cut	Mild Steel	½"	1"
B	2 Cuts	Stainless Steel	⅜"	¾"

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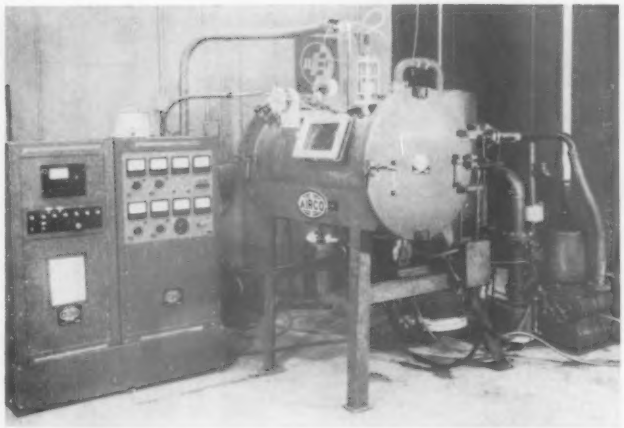
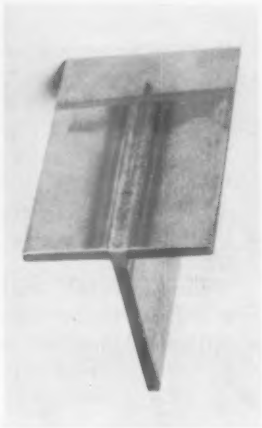
A WELDING SHOW FEATURE REPORT

Spotlight on fabricating



ELECTRON BEAM WELDER makes T-joint in stainless.



Fabricator uses versatile electron beam welder

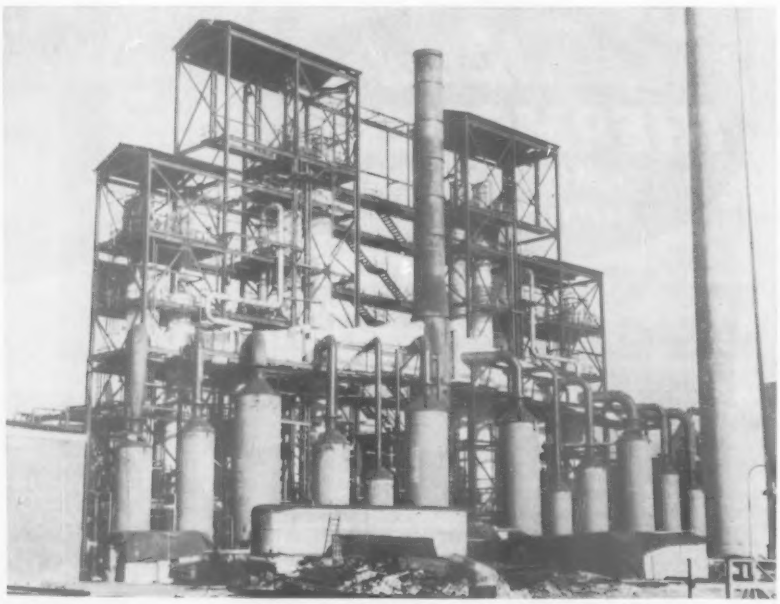
MINNEAPOLIS: A $35,000 electron beam welder being used by Rosemount Engineering's new Welding Division is said to be the first of its kind installed by a welding and fabricating company.

Advantages of the process over other welding methods include high efficiency, accurate control, cleaner and stronger welds, and successful welding of highly reactive metals (titanium, zirconium, hafnium) and refractory metals. The process is used for welding thin gage materials (edge and butt welds can be made on .001-inch-thick metals), for welding dissimilar metals, and for joining extremely small or thin parts to heavy sections. No edge preparation is needed.

Components are power supply (0 to 600 ma at 20,000 volts); welding head (an electron gun); and vacuum chamber (23-inch-diameter by 44 inches long, capable of fast pump down to high vacuum).

Tar distillation unit is lined with stainless mesh

PITTSBURGH: A major steel producer here has installed this new process equipment for tar distillation. It was designed by a leading process engineering and contracting firm. Main exhaust stack, breechings, ductwork, nickel alloy steel expansion joints, all completely lined with stainless steel mesh, were furnished and fabricated by Youngstown Steel Tank Co.



continued on page 93

Circle No. 68 on Reader Service Card. ⟶

LINDE COMPANY UNION CARBIDE

SIGMATIC

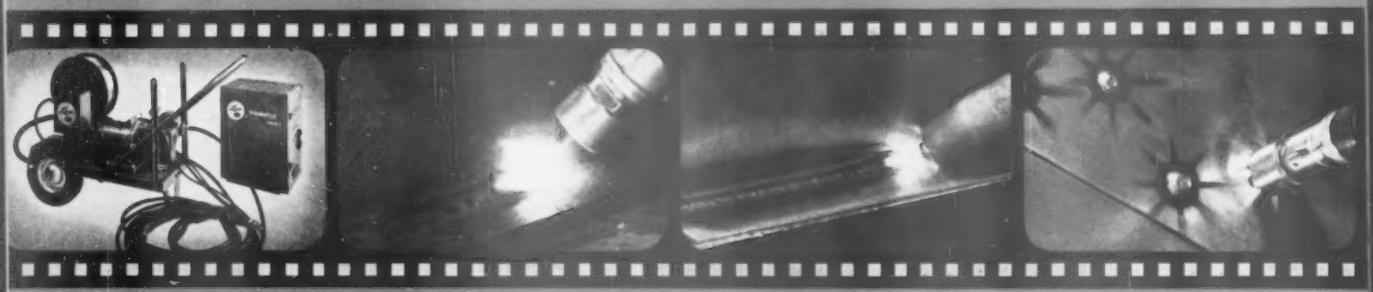
NEW ALL-IN-ONE "MIG" WELDING EQUIPMENT

Welding equipment is designed, developed and refined, but eventually it must be redesigned. LINDE'S new SIGMATIC line of "Mig" welding equipment is a product of this evolution . . . plus LINDE'S vast experience with more inert-gas and consumable-electrode processes than any other company in the world. The SIGMATIC line is the most-versatile semi-automatic equipment available anywhere—one machine for:

- **. . . all types of "Mig" welding—spray arc, short arc and spot welding**
- **. . . in all welding positions—vertical, overhead or downhand**
- **. . . with all shielding gases—argon, helium, CO_2, or their mixtures**
- **. . . and all wires—hard or soft, solid or tube**
- **. . . on all weldable metals—carbon steel, stainless, aluminum, magnesium, titanium**
- **. . . on all thicknesses—sheet metal and up**

See next page for details.

SIGMATIC



One SIGMATIC machine for... spray arc... short arc... spot welding

Spray arc, short arc, spot welding... never before combined in a single piece of equipment. SCC-8 control incorporates special spot-welding circuitry, featuring a directly-calibrated, precision weld timer and an independently-adjustable, "non-stick" timer. Converts from spot to continuous fusion welding at the flick of a switch. SEH-2 heavy-duty wire-feed unit—largest, most-rugged unit available today—permits positive feed of all "Mig" wire types, metals and diameters. The SIGMATIC line contains five basic units, designed with interchangeable parts permitting more than 50 combinations tailor-made to individual specifications. Available in cart-, sled- or bench-type units.

Unique controls are vastly simplified. All components are visible and accessible. Adjustments can be made with a screw driver. Only heavy-duty industrial-type parts are used throughout each unit to insure dependable, long-life performance with minimum maintenance. Top-quality parts—"Square D" pneumatic timers, Mallory electrolytic condensers, Cutler-Hammer switches, Potter & Brumfield relays, Electrons, Inc. thyratron tubes. The SIGMATIC line is unquestionably a major welding advance—with one rugged, durable machine, you can do any type of "Mig" welding in any position on any thickness of any metal. For more information or a live demonstration, call your nearest Linde office.

"Linde," "Sigmatic" and "Union Carbide" are registered trade marks of Union Carbide Corporation

LINDE COMPANY UNION CARBIDE

Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

Fabricator makes X-ray quality welds in ¾-inch aluminum

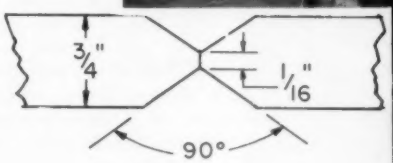
CLEVELAND, OHIO: Careful joint preparation and careful welding enabled Steel Fabricators Co. to make full penetration X-ray quality welds in 6-foot-diameter aluminum rings for a tire making machine. They rolled ¾-inch by 24-inch 6061-T6 aluminum plates into cylinders and welded them with the consumable electrode process, using argon shielding gas.

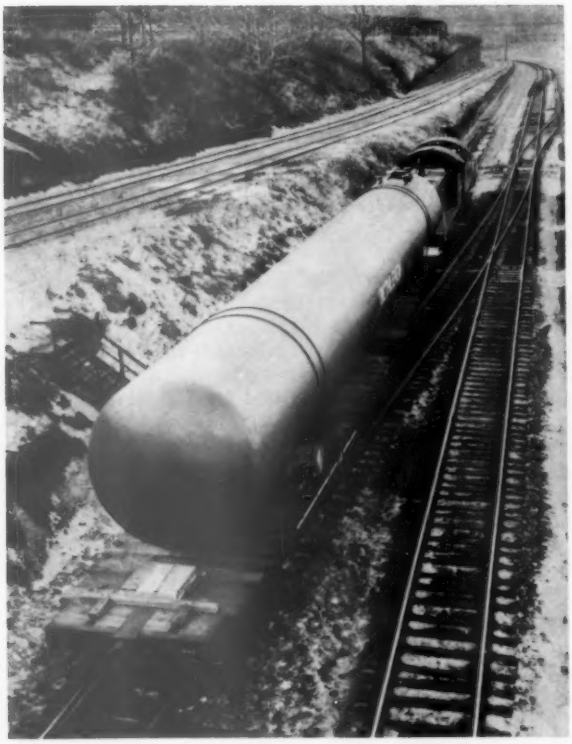
Steel Fabricators used double-Vee joints with 1/16-inch butted lands and 90° included angles (see sketch). They ground all joint surfaces and removed oxides with steel wool before welding.

First they made a root pass manually from the inside, using 1/16-inch-diameter 4043 wire.

Then they made three passes from the outside with 3/32-inch 4043 wire. This was done automatically on a welding manipulator.

Finally they back gouged to remove the root pass. Then they made four passes from the inside, using the welding manipulator and 3/32-inch 4043 wire.





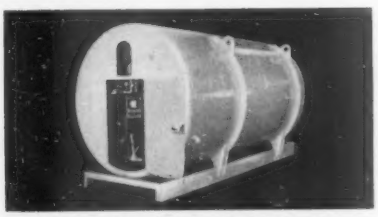
All-welded vessel operates at 300 psi and 250°F

BETHLEHEM, PA.: This all-welded propylene storage and feed vessel was shipped by Bethlehem Steel Company to a destination in Delaware. One of six fabricated in the company's weldment shop, it is designed to operate at a pressure of 300 psi and 250°F. Weighing over 85 tons, the tank is fabricated of 1 5/32-inch steel plate. It measures 100 feet long and has an inside diameter of 10½-feet. The tank is supported by two specially designed welded saddles permanently attached to the shell. Before shipment, the tank was radiographed and stress relieved to assure meeting design specifications.

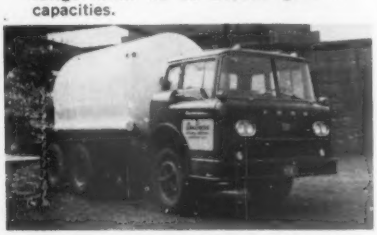
hofman VESSELS

FOR STORAGE AND TRANSPORT OF LIQUID OXYGEN, NITROGEN, ARGON

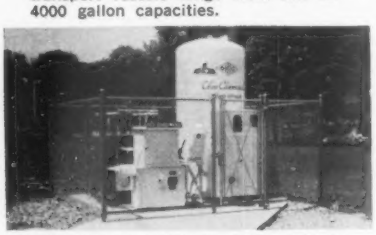
Save Space — Save Money
Eliminate Cylinder Handling



Hofman 300 gallon liquid oxygen storage vessel. Hofman storage vessels range from 15 to 28,000 gallon capacities.



Hofman 1000 gallon transport truck built for Southern Oxygen Co. Hofman transport vessels range from 500 to 4000 gallon capacities.



This Hofman central oxygen supply system includes a 300 gallon vertical storage vessel. System was built for Ohio Chemical Co.

Free!

New 54 page catalog. The largest line of low temperature equipment available. Also valuable cryogenic information.

hofman LABORATORIES, INC.

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Representatives in principal industrial and military centers.

Circle No. 54 on Reader Service Card.

REFERENCE DATA *catalogs, handbooks, manuals*

NEW ELECTRONIC SYSTEM of searching metallurgical and related literature for specific information is explained in an 8-page brochure from American Society for Metals. The brochure tells how electronic information searching reduces research costs and increases accuracy, speed, and effectiveness. Subscribers receive, every two weeks, information on anything published in the preceding two weeks in their field of interst.

Circle No. 300 on Reader Service Card.

GOVERNMENT SPECIFICATIONS for alloy steels are tabulated on a new chart issued by Peter Frasse & Co., Inc. The chart shows the chemical analysis requirements for the more widely used Military, Army-Navy Aeronautical and Federal alloy steel specifications. Specified forms (sheets, bars, tubing, etc.) are listed along with nearest corresponding SAE, AISI, and AMS numbers.

Circle No. 301 on Reader Service Card.

CONTROLLED ANGLE TORCH for tungsten inert gas arc welding is featured in Catalog WC-60. Described and illustrated is a new torch that can be adjusted manually to any angle or extended to reach hidden recesses. Manufacturer is Falstrom Company.

Circle No. 36 on Reader Service Card.

AN EASY-TO-USE 10-inch slide card distributed by Albert Pipe Supply Co. gives pipe, flange, and fitting information in a handy, permanent slide-rule card. On one side are tables on pipe sizes, schedule number, wall thickness, weight per foot, and pressure at yield on pipe from ⅛- to 24-inches. On the reverse side is data on welded flanges and fittings—size (2- to 30-inch), dimensions, and weight per piece.

Circle No. 302 on Reader Service Card.

TWO NEW WELDERS are featured in literature from National Cylinder Gas Division of Chemetron Corporation. Diesel-engine model SDD-250DC welder and model SDD-250-L DC welder with auxiliary AC power plant are described in Bulletin NH-182. Gasoline-engine model SGAD-225-L AC-DC welder/power plants are described in Bulletin NH-183.

Circle No. 303 on Reader Service Card.

FLAME-PLATED COATINGS are covered in a series of bulletins just prepared by Linde Company, Division of Union Carbide Corp. Bulletin F-1246-A lists the compositions and physical constants for six different coatings for metal parts. Bulletins F-9889-B, F-1435, and F-1436 give a more detailed list of properties and applications of the three tungsten carbide-cobalt coatings supplied by the company.

Circle No. 304 on Reader Service Card.

RAPID SELECTION of welding, brazing, and soldering alloys and fluxes is made possible by using a ready-reference wall chart offered by All-State Welding Alloys Co., Inc. The 19½- by 25½-inch chart lists All-State's complete line and gives complete information of alloys for joining aluminum.

Circle No. 305 on Reader Service Card.

FACTS AT YOUR FINGERTIPS: *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

WELDED FABRICATIONS and their design are explained in a brochure available from the Steel Fabrication Co. Discussed are the facilities of the company and its ability to fabricate a wide variety of metals.

Circle No. 96 on Reader Service Card.

MULTI-OPERATOR resistor units for individual control of welding arcs in multi-arc systems are described in a 4-page bulletin from J. B. Nottingham & Co., Inc. The bulletin gives complete operating characteristics and specifications.

Circle No. 342 on Reader Service Card.

WELDING HELMETS featuring Fit-Rite headgear are described and illustrated in a bulletin from Flood Safety Products Co. Bulletin No. 21 lists fiber glass and fiber helmets that have wide vision, stationary and lift-front lenses.

Circle No. 343 on Reader Service Card.

INFRARED COMFORT HEATERS for direct radiant heating of welding areas is described in new 8-page, 2-color Bulletin CH-100 available from Fostoria Corp. Principles, advantages, and typical applications are discussed.

Circle No. 344 on Reader Service Card.

AIR-OPERATED tangent bending machines are featured in 12-page Bulletin 13-093A available from Taylor Winfield Corp. Data correlates bending radius with flange height that can be smoothly contained during tangent bending of sheet steel.

Circle No. 345 on Reader Service Card.

WELDING TORCHES, cutting attachments, tips, economizers, regulators, and assemblies are described and illustrated in a 16-page catalog of Torchweld apparatus available from National Cylinder Gas Division of Chemetron Corporation. Included in booklet NTW-110 are diagrams of welding and cutting tips, and specification tables for tips, regulators, and torches.

Circle No. 346 on Reader Service Card.

A NEW PRICE LIST issued by Chicago Hardware Foundry Co. is for a new chrome-alloyed cast iron rod that practically eliminates all cracking or checking.

Circle No. 167 on Reader Service Card.

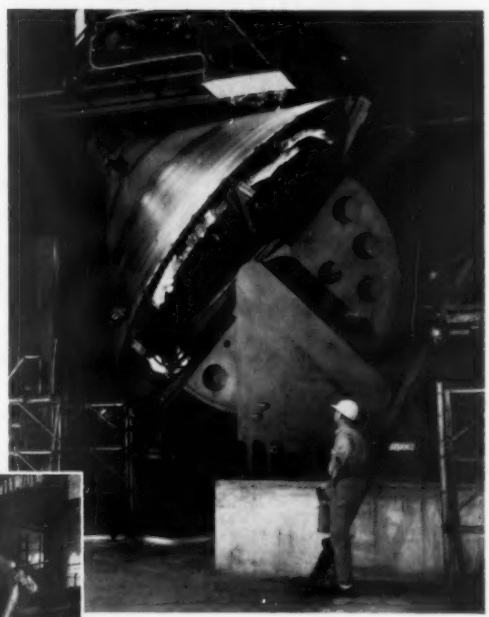
AUTOMATED RESISTANCE welding machinery which is said to increase production by 700% is completely described and illustrated in a folder available from Lors Machinery, Inc. Lors completely designs, engineers, and custom builds such machines as: high speed, multi-head, variable bed length welder; press type resistance welder designed for high output; and 30 head, programmed (pre-determined) sequence welder.

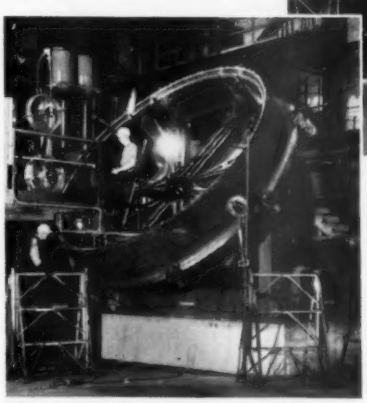
Circle No. 166 on Reader Service Card.

PROFITS are built on DEPENDABILITY

ARONSON Model G3500 "EXCALIBUR" Gear Driven Positioner is used by a large Eastern steel producer for hard-facing bell hoppers for blast furnaces. "EXCALIBUR" provides the greatest precision and economy in the handling of large workpieces.

"EXCALIBUR" is not a special job machine, but a Positioner that will handle 90% of those jobs you now wrestle around the shop floor with profit eating cranes.





"Excalibur" opens production doors that are closed to your competitors. "Excalibur" has been designed to handle almost every kind of weldment up to 175 tons at lowest possible shop cost — with the dependability that profits are built on.

ARONSON BUILDS THE MOST COMPLETE LINE OF POSITIONERS . . . WITH CAPACITIES RANGING FROM 25 POUNDS TO 600 TONS

Universal Balance® Positioners • Bench Turntable Positioners • Gear Driven Positioners Headstock-Tailstock Positioners • TracTred® Turning Rolls • Turntables Fully Automatic Positioners • Geared Elevation Positioners • Magnetic Welding Clamps

Write for detailed engineering data

Quality PRODUCTS by **Aronson MACHINE COMPANY, INC.**
ARCADE, NEW YORK

See our display in Booth 700 at the AWS Welding Show, New York Coliseum — April 18-19-20

For More Information Circle 113 on Reader Service Card.

BERYLLIUM COPPER strip products are the subject of a 12-page bulletin (S-1100-A) available from Beryllium Corporation. The bulletin describes the advantages of using beryllium copper, gives physical and mechanical properties, and tells how to select the right alloy for specific requirements. Five alloys are covered.

Circle No. 306 on Reader Service Card.

HOW PRE-HARDENING of SAE 4140 steel plate gives a high quality, low cost chrome-moly alloy steel that bridges the gap between SAE 1045 and tool steel is explained in a brochure from Burger Iron Company. The 4-page folder lists other grades of available steel plate and services the company performs on each, including flame cutting and horizontal surface grinding.

Circle No. 307 on Reader Service Card.

GAMMA RADIOGRAPHY cameras are described in a catalog sheet available from Radionics, Inc. How panoramic exposures are made with the 5 models in the 60 series is explained.

Circle No. 308 on Reader Service Card.

WELDING EQUIPMENT for use on thin metals is featured in a new short-form catalog from Hughes Aircraft Company's Vacuum Tube Products Division. The catalog illustrates nine different power sources and eight different weld heads and handpieces. Specifications are shown for all units.

Circle No. 309 on Reader Service Card.

RESIN BONDED SANDING DISCS for surfacing and finishing of metals, including aluminum, copper, and bronze, are featured in literature from Bates Abrasive Products Co. Other abrasive products featured include cup wheels, flexible cloth wheels, rolls, belts, and sheets.

Circle No. 310 on Reader Service Card.

ARC WELDING STAINLESS is the subject of Lincoln Electric Company's new Bulletin 7300.2. It gives physical properties, structure, and welding characteristics of the different types of stainless. It also lists deposit properties and electrode recommendation tables.

Circle No. 311 on Reader Service Card.

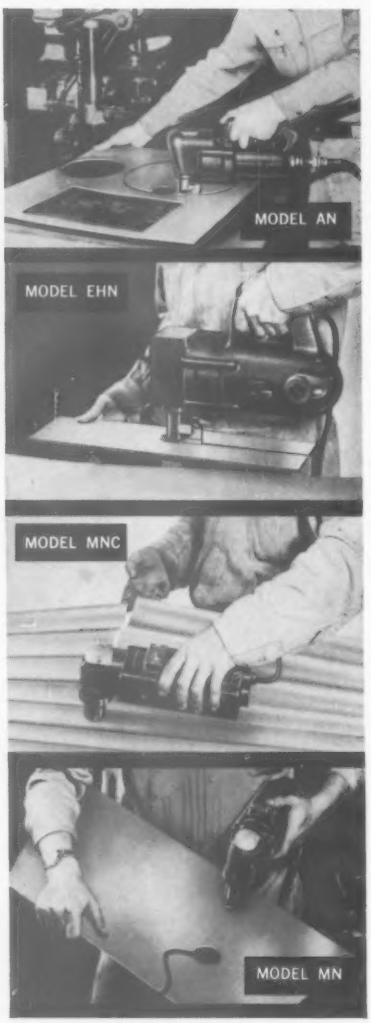
HIGH-STRENGTH, low carbon, alloy steel which can be welded by any process, is the subject of literature from Great Lakes Steel. N-A-XTRA high-strength is heat treated and is available in minimum yield strengths ranging from 80,000-110,000 psi. It is readily formed and fabricated.

Circle No. 334 on Reader Service Card.

"SEAMLESS WELDING FITTINGS and Flanges" is the title of an illustrated 8-page booklet published by the Tubular Products division of Babcock & Wilcox Co. Included in booklet FB-502A are charts of standard sizes and schedules according to ASA B36.10 and ASA B36.19.

Circle No. 312 on Reader Service Card.

VERSATILE PORTABLE NIBBLERS CUT METALS* RIGHT ON THE JOB



No matter the kind of metal or shape to be cut, FENWAY NIBBLERS (air powered or electric) operate with a cutting action which displaces the metal without distortion on both sides of the sheet: insures finished smooth edge, no chipping, no binding, no curling, no flaking . . . Cuts inside circles, squares, odd shaped holes on a per job or production line basis—saves time and materials in every application . . . Portable, light in weight, (8-20 pounds depending on model)—safe, easy to handle, proved durable in critical operations, minimum maintenance, guaranteed unconditionally.

*THE FENWAY NIBBLER CUTS: All non-ferrous metals, copper, brass, aluminum, etc. 10 gauge stainless steel and lighter; 8 gauge mild steel and lighter; tough pitch or asbestos coated corrugated steel ¼" cold or hot rolled steel and 5/16" aluminum.

Write Today for Complete Specifications, or Free Demonstration in your area.

FENWAY
MACHINE COMPANY, INC.
1910 North Marshall St., Phila. 22, Pa.

For More Information Circle No. 37 on Reader Service Card.

GROUNDING VESSELS on turning rolls for welding by using the new Aronson W-O-R-M (Weld-On-Rotating-Mercury) Ground is explained in a bulletin from Aronson Machine Co., Inc. Prices are given.

Circle No. 313 on Reader Service Card.

PORTABLE air-powered and electric tools are featured in 72-page Catalog No. 61 from Buckeye Tool Corp. It lists all Buckeye tools, gives general information on the firm and its facilities, lists their sales representatives.

Circle No. 314 on Reader Service Card.

SINGLE ACTION, straight side, single crank, Warco presses in capacities from 60 to 400 tons are described and illustrated in 8-page Bulletin No. 52181 from the Federal Machine and Welder Co.

Circle No. 315 on Reader Service Card.

PIPE-CUTTING PANTOGRAPH is subject of 6-page Bulletin No. P-10 published by Vernon Tool Co., Ltd. Two models are described: C, for making cutoffs in pipes of any length in 2- to 24-inch diameters; and G, for heavy-duty cutoffs, miters, lateral and tee intersections on 8- to 42-inch diameters weighing as much as 400 lb. a foot. Construction and features are given for both models.

Circle No. 316 on Reader Service Card.

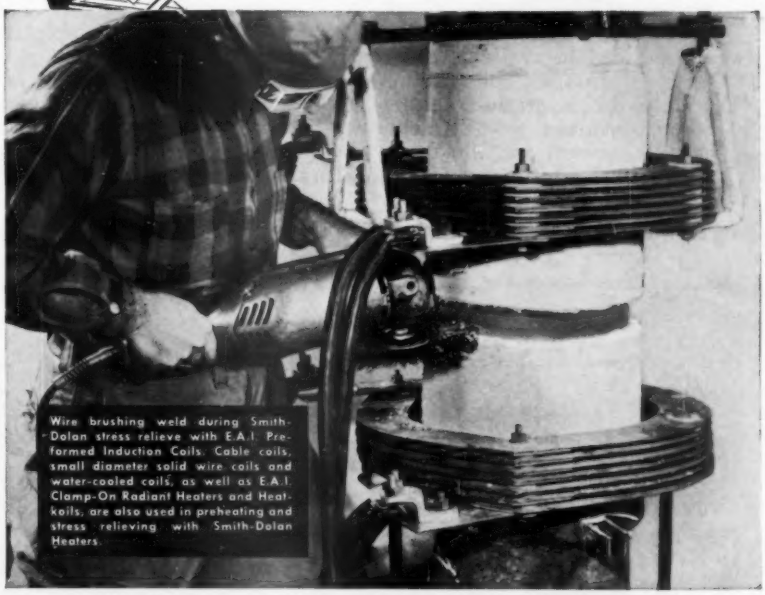
FLAME SAW of the gantry type for multiple ripping to any length, and width is described in Folder 1290 prepared by Ty-Sa-Man Machine Co., Inc. General specifications for machine (Model 122 FSM Ripper) include those for track cross rail, and track travel with push button, variable-speed drive and fast reverse. Model 122 FSOM-48 is also described. It's an end trimmer when used with FS M on common track.

Circle No. 317 on Reader Service Card.

TOGGLE CLAMPS are listed in 16-page Catalog No. 6 available from the Wespo Division of Vlier Engineering Co. Specifications, detailed drawings, and illustrations are given for each clamp. Clamp parts and accessories are also listed.

Circle No. 318 on Reader Service Card.

Profit through E.A.I. Research



Wire brushing weld during Smith-Dolan stress relieve with E.A.I. Preformed Induction Coils. Cable coils, small diameter solid wire coils and water-cooled coils, as well as E.A.I. Clamp-On Radiant Heaters and Heat-koils, are also used in preheating and stress relieving with Smith-Dolan Heaters.

For Safety, Simplicity and Efficiency In Stress-Relieving Weldments

use proved Smith-Dolan 60-cycle heating

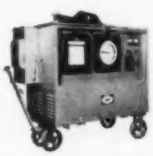
Eliminate Hazards to Personal Safety—No dangerous voltages are involved when using Smith-Dolan 60-Cycle Induction Heaters.

Eliminate Superficial Heating — Gives even, through-and-through heating of wall thicknesses up to four inches and more.

Eliminate High Maintenance Costs—A transformer type machine . . . no rotating parts to wear . . . practically no maintenance needed.

Eliminate Complicated Operation — Self-regulating and voltage stable . . . uses most commonly available commercial voltages . . . on-off operation by inexpensive, durable contactors . . . dual circuit for greater versatility, controlled voltage . . . no technical training needed for expert operation, only a few hours of on-job instruction.

Eliminate Power Losses — 92 to 95% efficient; losses are lowest of all electrical apparatus.



Developed over many years and proved around the world, E.A.I. Smith-Dolan equipment is *designed to meet every stress-relieving requirement with minimum expenditure.* Rental against purchase . . . get first-hand proof in your own plant without capital investment.

Illustrated Brochure on Request

Electric Arc, inc.

152-2 Jelliff Avenue, Newark 8, N. J.

Bigelow 3-3211

Representatives in Principal Cities

ELECTRIC-ARC INC.

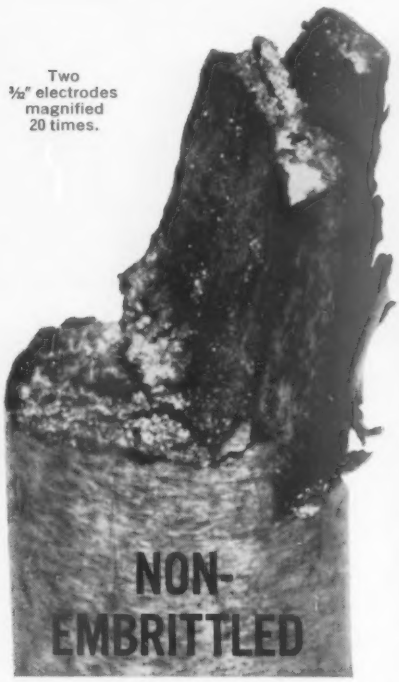
For More Information Circle No. 33 on Reader Service Card.

ELECTRONIC LINE TRACER, for use on National Cylinder Gas Division of Chemetron Corp's Type R flame cutting machines is described in available literature. Advantages, construction, principles of operation, and detailed operation of the tracing head are given, and illustrated schematically. User case history cost savings are included.

Circle No. 319 on Reader Service Card.

MECHANIZED HAND CUTTER for fast, accurate cutting of flat or tubular steel plate is described in literature prepared by Steffan Manufacturing Corp. Applications of the Model HC-100 are thoroughly explained and illustrated, showing how the magnetic center and floating radius rod work to cut tank openings, or plate circles, and how it can be used for irregular and stand-up cutting. Cutting guide is included.

Circle No. 320 on Reader Service Card.



Non-embrittled electrodes don't break clean. The resulting splinters and jagged edges invite weld pool contamination, forcing the welder to break 'em over and over. You lose money!

PRECISION-ANNEALED G-E TUNGSTEN ELECTRODES ALWAYS BREAK CLEAN, SAVE YOU MONEY!

Every General Electric Tungsten Electrode is precision annealed to break clean and square—easily. No splinters. No jagged edges. This feature reduces contamination of the work piece when the arc is struck on the cold electrode—especially when you use high current values. They're easier to feed through the collet, too.

Cut tungsten losses and improve welding performance with G-E Hi-Purity, 1% thoriated, or 2% thoriated electrodes. See your welding supplies distributor or contact General Electric Co., Lamp Metals & Components Dept. WDF-41, 21800 Tungsten Road, Cleveland 17, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For More Information Circle No. 42 on Reader Service Card.

THERMOPLASTIC welding is explained in a 4-page brochure from Kamlar Products Co. Operating instructions are given in Manual 60-2 for welding and tacking plastics with the company's electrically powered welding equipment.

Circle No. 321 on Reader Service Card.

PRECISION HOLDING devices for rapid production are featured in a catalog from Heinrich Tools, Inc. The catalog explains how the company's complete line of vises, clamps, and locking units can speed operations, increase production, and cut tooling costs.

Circle No. 322 on Reader Service Card.

AUTOMATIC ARC-WELDING machines for mass production are the subject of a bulletin from Taylor-Winfield Corp. Bulletin 8-513-A illustrates typical examples of custom-made arc welding machines for specific automatic production line welding.

Circle No. 323 on Reader Service Card.

A LONGITUDINAL WELDING positioner is the subject of Bulletin AW-11-60 just issued by Airline Welding & Engineering. The brochure gives design details and operating instructions for the company's Series 11300 basic longitudinal welding positioner.

Circle No. 324 on Reader Service Card.

CRYOGENIC storage vessels are the subject of new 16-page Brochure G-50 issued by Chicago Bridge & Iron Co. The brochure describes design of double-wall storage vessels, insulation systems, materials of construction and accessories. Illustrations include drawings and photographs of several CB&I-built cryogenic storage vessels.

Circle No. 325 on Reader Service Card.

LIQUID GAS storage and transportation vessels are described in a 64 page catalog available from Hofman Laboratories, Inc. Also featured are a line of low temperature equipment and cryogenic information.

Circle No. 54 on Reader Service Card.

PORTABLE FLAME CUTTING with one or more torches on a motorized carriage is the subject of literature released by Oxo Equipment Co. Unit, with economizer, is described as saving fuel gas and oxygen, having instantaneous flame control, fast starting, and making better cuts with less slag and kerf melting.

Circle No. 326 on Reader Service Card.

CUTTING MACHINES manufactured by Messer Cutting Machines Inc., are described in an illustrated, 8-page brochure chure published by the company. Corta 52, Statosec, Statosec SW, Sine-Cosine, Billet, and Portal machines are thoroughly described, giving their ranges of application—from small to ship-plate sizes, principles of operation, and the tracing devices used on each.

Circle No. 327 on Reader Service Card.

REPAIR of broken shafts, rolls, machine frames and other heavy parts by the Thermit welding process is described in a 6-page data sheet from Thermex Metallurgical, Inc. The sheet gives complete step-by-step instructions for the wax pattern process.

Circle No. 328 on Reader Service Card.

A COMBINATION layout and cutting square is described and illustrated in literature from R. C. Fessler & Company. Literature explains that tool is fastened in place magnetically and how it can eliminate clamps and cutting guides.

Circle No. 329 on Reader Service Card.

WELDING PLATENS are described and illustrated in a brochure available from the Acorn Iron and Supply Co. Complete specifications are given for different models that can be used by shipyards, welding shops, and pipe and plate fabricators.

Circle No. 8 on Reader Service Card.

CARBON BLOCK BRAZERS and tensile-elongation testers for copper wire are described and illustrated in a brochure from the M. G. Steele Co. Specifications, engineering data, and prices are included.

Circle No. 330 on Reader Service Card.

...Low Glare & Low Fuming Characteristics Assure Operator Comfort & Quality Results

GB 88 Flux is recommended for silver brazing steel, brass, copper, stainless steel, monel, inconel, chrome alloys, silver and gold. It is known throughout the industry as the "Production" flux . . . proved and dependable. Because operators recognize an improvement in the quality of their silver brazing jobs when they use GB 88. And they like its glare and low fuming characteristics.

GB 88 Flux is stable in use as well as in storage. It is fully active to 1650°F. Order GB 88 Flux in the size container that suits your needs.

For best results team up GB 88 Flux with GB Silver Brazing Alloys in the shape and size your jobs call for: random coils in all diameters, strips, straight lengths, pre-formed rings and special shapes.

Write for details. A FREE working sample of GB 88 Flux will be supplied promptly on request.

Goldsmith Bros.
DIVISION OF NATIONAL LEAD CO.
900 WEST 18th STREET • CHICAGO 8, ILLINOIS
For More Information Circle No. 44 on Reader Service Card.

PORTABLE FLAME CUTTER, said by Indiana Oxygen Co., the manufacturer, to be "engineered versatility", is described in literature available from them. Their Cut-A-Line machine, they say, features one hand control, constant speed, forced draft coolness, and compatibility with any torch. Line drawings and photos show one-, and multiple-torch applications.

Circle No. 331 on Reader Service Card.

TRACER-OVER-TORCH MACHINE, called Ultra-Graph, is described and illustrated in literature from the manufacturer, Heath Engineering Company. Literature explains how these room-saver machines (for portable or stationary use) easily and accurately duplicate patterns with magnetic follower. Construction drawings illustrate features of four machine series. Specifications and cutting ranges are given for all four.

Circle No. 51 on Reader Service Card.

COMPARE

and you'll get a BIG NEW

Johnson model J

HEAVY DUTY METAL CUTTING BAND SAW

Capacity — 10" rounds, 18" flats • *Motor* — ¾ hp (Any voltage available) • *Wheel Diameter* — 16" • *Floor Space* — 66" x 31" • *Bed* — 11" wide, 44" long, 6" deep, 24" high • *Overall Height* (closed) — 39" • *Weight* — Approx. 750 lbs. • *Speeds* — 36, 90, 130, 190 feet per minute.

COMPARE the handsome, husky Jonhson Model J with any metal cutting saw and here's what you'll find:

- *Johnson leads the way in dependable, well-engineered, high performance band saws.*
- *A Johnson saw will cut anything in your stock pile, and do it faster.*
- *Johnson saws contain more exclusive construction and performance features that save time and money.*
- *Johnson saws are the finest metal cutting machines available anywhere—and, at the lowest price!*

COMPARE . . . and see for yourself how easily you can save time, labor and production dollars with a Johnson saw. Complete information, prices — are yours for the asking.

Johnson MANUFACTURING CORPORATION
1020 BARNES ST., ALBION, MICHIGAN

Eastern Distributor	*Midwestern Distributor*	*Western Distributor*
R. J. R. KELLY CO.	W. O. LUNDMARK	HASTINGS DISTRIBUTORS
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East Orange, N. J.	Des Plaines, Ill.	Berkeley, Calif.

For More Information Circle No. 58 on Reader Service Card.

FABRICATIONS of large and small shapes to meet the most exacting specifications are featured in a brochure offered by Littleford Bros., Inc. Illustrations of the many facilities and of typical weldments done by them are included.

Circle No. 332 on Reader Service Card.

LIQUID GAS storage vessels and accessory equipment are described and illustrated in a 64 page booklet available from Hofman Laboratories, Inc. Booklet includes charts giving such information as: data on liquefied atmospheric gases, evaluation of one liter of liquefied gas, and conversion factors for units of volume, mass, pressure, and energy.

Circle No. 54 on Reader Service Card.

WELDING ACCESSORIES and safety equipment are described in a sixteen page catalog offered by Jackson Products, Air Reduction Sales Co. Catalog contains complete specifications on all Jackson products listed.

Circle No. 56 on Reader Service Card.

"THE INSIDE STORY of Outside Help" is the title of an eight page brochure which discusses the operations and services of Mutto Manufacturing Company. The brochure explains how the completely equipped metal fabricator can produce made-to-order products or produce component parts or complete products on a contract basis.

Circle No. 333 on Reader Service Card.

CERTIFIED SILICON RECTIFIERS and stacks are listed in Bulletin No. 300 published by the Semi-Conductor Division of Syntron Company. General electrical and mechanical specifications, typical operating characteristics, and cutaway drawings describe the rectifiers.

Circle No. 335 on Reader Service Card.

HARD SURFACING electrodes called Hardalloy 55 are featured in a data sheet from The McKay Company. Data includes mechanical properties, composition specifications, and sizes, weights and coverages.

Circle No. 336 on Reader Service Card.

"SPOT WELDING of Hardenable Steels" is the title of a brochure available from Taylor Winfield Corp. The illustrated 8-page Booklet SP-6A describes equipment and procedures for welding hardenable steels. Complete spot welding data is given in several tables for different types and thicknesses of steels.

Circle No. 337 on Reader Service Card.

FLAME-CUTTING machines are described in a 28-page catalog available from Linde Company, Division of Union Carbide Corporation. Form 1396 lists specifications for cutting machines ranging from small, portable units to huge, multi-torch machines. The company's new photocell tracer is also described.

Circle No. 338 on Reader Service Card.

A NEW CONSTRUCTIONAL ALLOY steel is featured in literature from Jones & Laughlin Steel Corp. A multi-color brochure contains detailed information about Jalloy-S. Tables list chemical and mechanical properties of the steel, plus selected engineering information.

Circle No. 339 on Reader Service Card.

"THREE KEYS TO SATISFACTION" is a 77-page guide to designing, selecting, and heat treating steels. It is illustrated with charts and tables. Climax Molybdenum Company, a division of American Metal Climax Co., offers the book.

Circle No. 340 on Reader Service Card.

NEW ABRASION-RESISTANT steels are featured in literature from Jones & Laughlin Steel Corp. A multi-color brochure contains detailed information about the Jalloy-AR series of steels. Tables list chemical and mechanical properties of the steels, plus selected engineering information.

Circle No. 341 on Reader Service Card.

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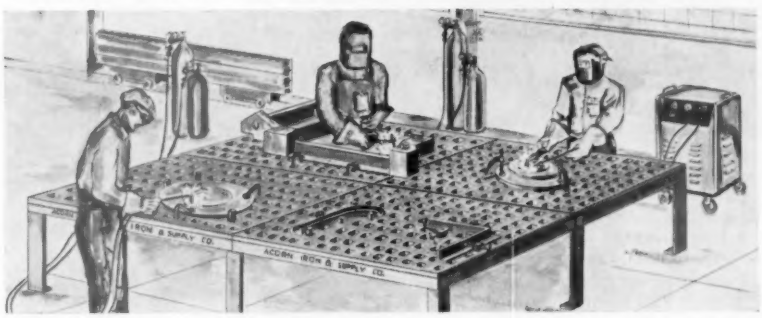
for research, design, and development . . . metal fabrication, maintenance and plant engineering

Layout and Set-Up Blocks or Welding Platens

BENDING BLOCKS • BED PLATES • SURFACE PLATES • FLOOR PLATES



Each ACORN Bending Block or Welding Platen has 1¾" square holes, 3½" center-to-center, for clamping, dogging or spacing. Working surfaces and side edges are machined within .005" of flatness. Blocks are semisteel castings with 30,000 to 32,000 psi tensile strength. A wide variety of accessories are also available.

WRITE TODAY FOR COMPLETE LITERATURE

Used singly or in multiple groupings ACORN Welding Platens or Bending Blocks are standard equipment in many shipyards, railroads, pipe and steel fabricators, welding shops, research laboratories, and wherever metal is formed, shaped or welded.

MODELS

These models are in stock:

2650	2'6" x 5'
4040	4' x 4'
5050	5' x 5'
5060	5' x 6'
5080	5' x 8'
3610	3'6" x 10'

ACORN
IRON & SUPPLY CO.
Delaware Avenue at Poplar Street
Philadelphia 23, Pennsylvania

Circle No. 8 on Reader Service Card.

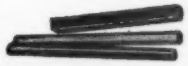
WELD WITH *Tipaloy*

YOUR Resistance Welding Electrode NEEDS Are OUR Business!

Whether it be:

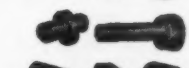
TIPS:

ROD or BAR:



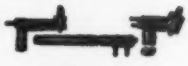
SEAM WELDING WHEELS:

FORGINGS:



CASTINGS:

HOLDERS:



ADAPTERS:

SPECIAL WELDING DIES or FIXTURES: TIPALOY *has them.*

BUY TIPALOY and save money!

TIPALOY can supply you with: RWMA Class #1, Tipaloy #100 RWMA Class #2, Tipaloy #130* RWMA Class #3, Tipaloy #200 and other RWMA classes of alloys to fit your needs.

It is unwise to pay too much, but it is worse to pay too little!

Use TIPALOY and get 30% to 100% more performance for your money than you are now getting.

BUY TIPALOY and get TIPALOY QUALITY

Send your trial order today

***TIPALOY #130 cast and processed under our patents.**

FREE: Write for your copy of Tipaloy's comprehensive new catalog.

Distributors and Representatives: Write for complete information about available territories.

REPRESENTATIVES IN PRINCIPAL CITIES
Tipaloy INC. 1435 E. MILWAUKEE AVE. DETROIT 11, MICHIGAN

Circle No. 101 on Reader Service Card.

Weldits

NEW Jet-Stream

"707"

CUTTING TORCH

CUTS SMOOTHLY
CUTS ACCURATELY
CUTS COSTS . . .

- Light . . . rugged . . . versatile . . . cuts up to 15" of metal using any kind of gas . . . propane, acetylene or LOW PRESSURE NATURAL!
- Built-in pressure control system and injector type mixing chamber . . . for smooth, accurate cutting without jump, backfire, or flashback!
- Heavy-duty forged bronze head and monel tubing for extra long-life service!
- New tip design—specially-developed for use with all types of fuel gases!
- Silver brazed joints!
- Choice of 70° or 90° head!

CONVERT YOUR WELDING TORCH TO A CUTTING TORCH IN SECONDS

NEW "707-45"

INJECTOR-TYPE CUTTING ATTACHMENT

- Fits Any Weldit J-Type Handle!
- Easily Attached Without Special Tools or Additional Components!
- Operates on Propane, Acetylene or Natural Gas!

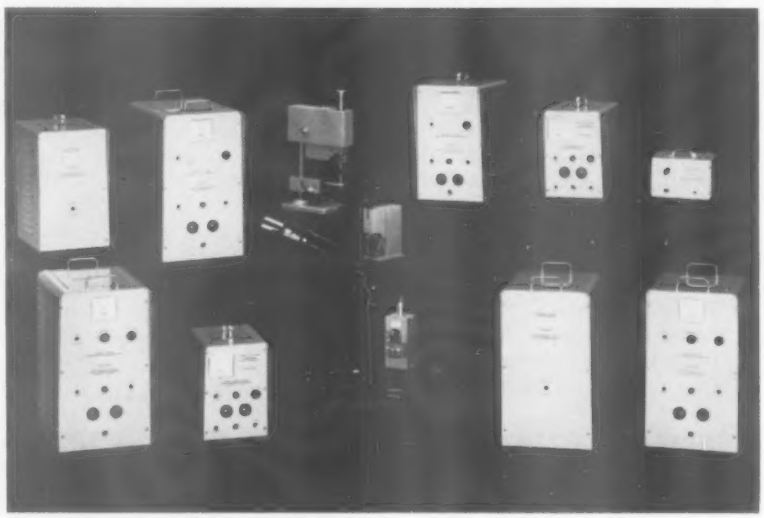
Write for Complete Information Today!

WELDIT INC.
990 OAKMAN BLVD.
DETROIT 38, MICHIGAN

DISTRIBUTORS: Write for details on valuable Weldit sales territories now open.

Circle No. 106 on Reader Service Card.

NEW PRODUCTS



Thin Metals Welder

A new line of stored-energy welders, designed for the manufacture of precision electronic components, has been developed by the Vacuum Tube Products Division of Hughes Aircraft Co. The complete line includes six stored energy power supplies and five welding heads and handpieces.

For More Information Circle No. 200 on Reader Service Card.

Turntable Positioner

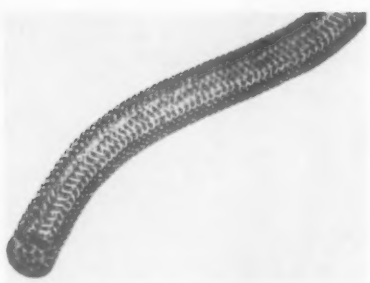
A new precision positioning and rotating machine has been developed by Boesch Mfg. Co. for welding or fabricating. Assemblies weighing 2000 pounds can be mounted on the 32 inch diameter flat faceplate and tilted from vertical to 15° beyond horizontal. Rotating speed is adjustable from 0 to 4 RPM. Model No. is PM-1051.

Circle No. 201 on Reader Service Card.

Nuclear-Grade Welding Wire

The All-State Welding Alloys Co., Inc. has announced that its aluminum welding and brazing alloys 718, 1100, and 4043 are available with "Nuclear" grade certification. Nuclear grade alloys are certified to limit unwanted elements. Lithium (0.008% max.), cadmium (.001% max.) and boron (.001% max.) absorb neutrons and reduce atomic reactor efficiency. Cobalt (.001% max.) becomes dangerously radioactive when bombarded with neutrons.

Circle No. 202 on Reader Service Card.



Multi-Conductor Cable

A new large-capacity electric cable that can be bent and looped without damage has been announced by Electric Arc, Inc. Called Ni-Coil, cable comes in 250- to 1000-ampere capacities. It's expected use is as the induction coil in stress relieving and as a replacement for braided shunts between moving parts. Ni-Coil is made of nickel-plated conductors encased in a woven niplate copper sleeve and in sizes ranging from 210,000 to 500,000 circular mills.

Circle No. 203 on Reader Service Card.

"DON'T ASK AMERICA WHAT SHE CAN DO FOR YOU, INSTEAD ASK WHAT YOU CAN DO FOR AMERICA."

from President Kennedy's Inaugural Address

WE AGREE

American Brazing Alloys Corp. pledges to cut costs and to cut profits for TREMENDOUS PRICE SAVINGS on our alloys

MADE IN AMERICA
BY AMERICAN CRAFTSMEN
IN AN AMERICAN FACTORY

low fuming bronze · nickel silver · silver solder · phosphor copper · phosphor silver · silicon bronze · deoxidized copper · nickel bronze

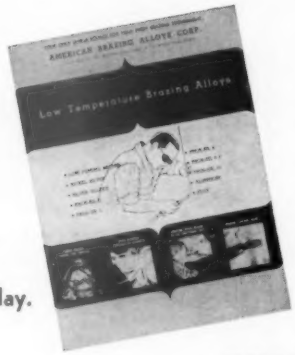
All alloys made in strict accordance with ASTM, AWS and federal specifications

We fully guarantee all alloys to be of the finest quality available at tremendous price savings

SAMPLE OFFER

5 lbs.	1/8	Low Fuming Bronze	@ .65 per lb.
5 lbs.	1/8	Silicon Bronze	@ .77 per lb.
5 lbs.	1/8	Deoxidized Copper	@ .68 per lb.
5 lbs.	1/8	Nickel Bronze	@ .68 per lb.
5 lbs.	1/8	Nickel Silver	@ .87 per lb.
5 lbs.	1/8	Phos Sil 0	@ 1.90 per lb.
5 lbs.	1/8	Phos Sil 2	@ 2.30 per lb.
5 lbs.	1/8	Phos Sil 6	@ 2.83 per lb.
5 lbs.	1/8	Phos Sil 15	@ 4.10 per lb.

1/16 — add .15 lb. 3/16 — subtract .02 lb.
3/32 — add .08 lb. 1/4 — subtract .04 lb.



Write for this free catalog today.

May we quote you on quantity purchases?

Do you run into delayed deliveries on foreign rod?	Not with Ambraze
Do you find variations in quality?	Finest quality at Ambraze.
Do you need technical help?	Just call Ambraze.
Are you concerned about competitive prices?	Ambraze has the lowest prices.
Do you want American made alloys?	Ambraze has them.

DEALER INQUIRIES INVITED

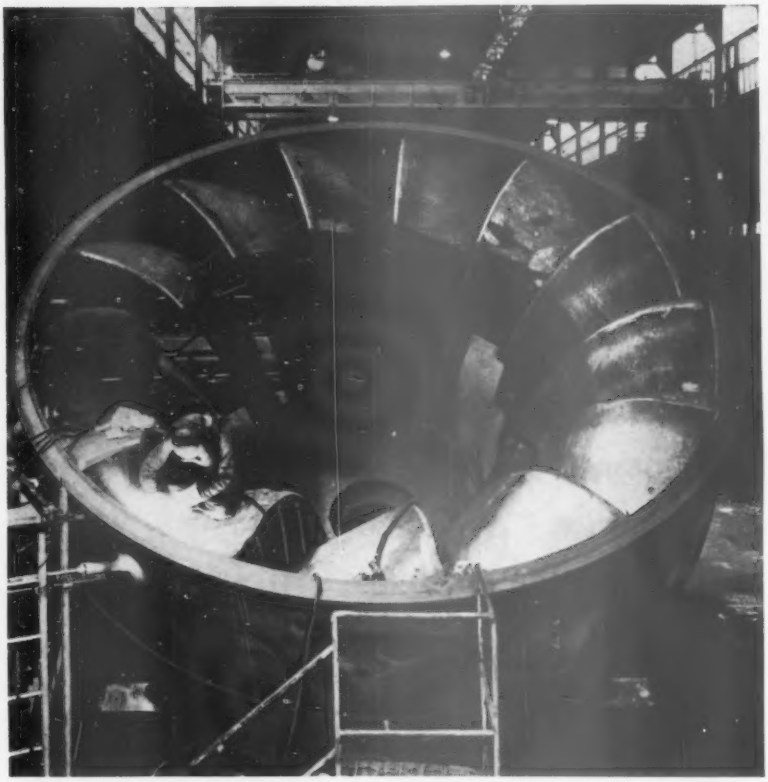
American Brazing Alloys Corp.

Booth 630
AWS Show

P.O. BOX 11 • PELHAM, N.Y. • MOUNT VERNON 4-5858

For More Information Circle No. 10 on Reader Service Card.

WELD WITH ARCOS STAINLESS ELECTRODES



Job Report Courtesy of Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin

Hydraulic turbine runner blades overlaid to resist cavitation. To protect the blades of this huge hydraulic turbine runner from the destructive effects of water wear, Arcos stainless rods were selected for overlaying critical areas. The precise chemical and metallurgical properties of Arcos stainless rods—assuring uniform, predictable results—make this process both dependable and economical. Meet your stainless welding requirements with Arcos—the most complete selection available anywhere.

ARCOS

Arcos Corporation • 1500 S. 50th St. • Philadelphia 43, Pa.

For More Information Circle No. 17 on Reader Service Card.

200 Series Regulator

A new series of regulators are claimed by the manufacturer, Kim Products, Inc., to perform like a two-stage regulator with the economy of a single-stage regulator. Output pressures are unaffected by varying inlet pressures, and flow capacity is not restricted by extra valving. Kim gages are unaffected by overpressure, even full-tank pressure.

Circle No. 204 on Reader Service Card.

Inert Arc AC Welders

A new line of M&T Murex inert arc welding machines has been announced by Metal & Thermit Corporation. Models have outputs of 200-, 300- and 400-amperes respectively. Each has a gas afterflow device instead of complicated timers. Alos featured: spark gap oscillator with silencing circuit, forced draft cooling, extra-heavy copper windings, and double glass insulation. Remote control is provided for high frequency, gas and water.

Circle No. 205 on Reader Service Card.

Grouser/Sprocket Rebuilder

A new tractor grouser shoe and drive sprocket rebuilding machine is being marketed by Victor Equipment Co. The rebuilder automatically flame trims tractor pads and welds on new grouser bars in 11 minutes. It can rebuild a D8 sprocket rim in less than 2 hours. Its cutting torches and semi-automatic, 500 amp a.c. welder can also be used for other work.

Circle No. 206 on Reader Service Card.

Precision Welder

A welding head built for precision assembly of electrical parts has been announced by the Weldmatic Division of Unitek Corp. The unit (Model 1038) is capable of making single, series, or parallel welds in fine wire, ribbon, and foil. Model 1038 features a 500-watt-second power rating, foot controls, electrode pressure contro', automatic firing, and will operate wit'i a full range of stored-energy power supplies.

Circle No. 207 on Reader Service Card.

Inert Gas Welder

Two all-purpose a.c.-d.c., inert-gas-shielded-arc welding machines have been announced by the Hobart Brothers Co. Both Model ADI-2641 (200 amps) and Model 3641 (300 amps) can be used for manual, automatic, tungsten inert-gas, inert-gas spot, or consumable-electrode welding.

Circle No. 208 on Reader Service Card.

Sanding Roll

An air inflated sanding roll has been introduced by Nu-Matic Grinders Inc. for high production sanding of either flat or contoured surfaces. Called Model 360, the 3-inch diameter by 6 inch long rubber drum will sand large surfaces without gouging. A ball bearing handle can be attached to the outboard end of the roll.

Circle No. 209 on Reader Service Card.

Aluminum Flash Welder

A flash welding, Model F-3, for welding mitered corners of extruded aluminum members has been designed by the Thomson Electric Welder Co. The machine clamps the work in both vertical and horizontal planes during welding. One end of the cabinet frame contains the 150 KVA water-cooled transformer, a thermal protective device, and a series parallel terminal board to provide 16 points of heat.

Circle No. 210 on Reader Service Card.

WELD WITH ARCOS FOR QUALITY WELD METAL

Arcos offers a complete line of filler metals for welding stainless, low alloy steels, mild steels, aluminum, and for hard surfacing . . . manually or automatically. Arcos covered electrodes, electrode wires, and filler rods are available for manual arc, submerged arc, inert gas, CO_2 shielded, and electroslag processes. The quality of all Arcos filler metal products, including fluxes for submerged arc welding and EB Inserts for root pass welding, is carefully controlled. *Make* sure it's Arcos . . . *be* sure of top performance.

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For More Information Circle No. 18 on Reader Service Card.

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For More Information Circle No. 20 on Reader Service Card.

High Speed Welder

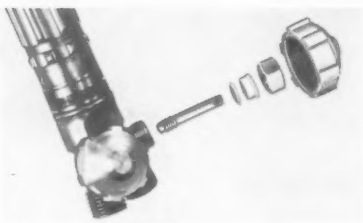
A new d.c. welder, Sureweld DRCP-33, with continuous voltage and slope adjustment, has been announced by the National Cylinder Gas Division of Chemetron Corp. Rated 300 amperes at 100 percent duty cycle, the welder can join 0.030-inch-thick metals without burn-through or spatter at relatively high speeds. Optical water cooling is available.

Circle No. 211 on Reader Service Card.

Manganese-Nickel Electrodes

An a.c-d.c. 11-13½ percent manganese-nickel welding electrode, Manganal Flo-Kote, has been developed by the Stulz-Sickles Co. Deposits are said to be tough, strong, and resistant to wear and impact. The steel core, not the flux, contains six alloys. The coating eliminates the need of peening and bead-weaving.

Circle No. 212 on Reader Service Card.



New Torch Valve

The Dockson Corp. has announced an improved valve for their welding and cutting torches. The new valve is less vulnerable to damage from blows or drops. New solid brass positive grip handles are press-fitted on the valve stems. Valve stems have oversized, lifetime packing sleeves of anti-friction teflon.

Circle No. 213 on Reader Service Card.

Fiber-Backed Abrasive Disc

A new abrasive disc for light grinding has been developed by the Coated Abrasives Division of Carborundum Company. The abrasive grain-resin bond construction makes the disc extremely sharp and fast cutting with unusual resistance to loading and coating breakdown.

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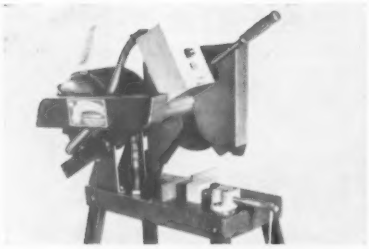


Abrasive Cutoff

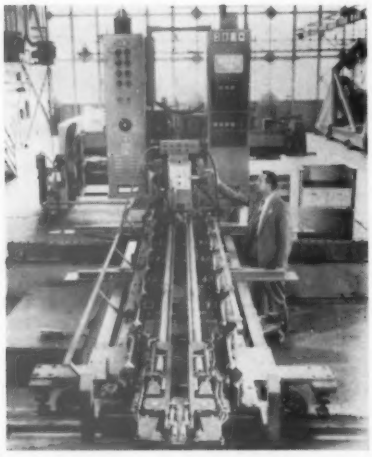
A new abrasive cutoff built for general production use has been announced by Beaver Pipe Tool, Inc. The machine (Speedcut No. 11) cuts through 3 inch shapes and 1½ inch solids. It uses an 11-inch wheel with a 1-inch bore, and is equipped with drive pins. No. 11 weighs 136 pounds and is 21½ inches tall.

Circle No. 215 on Reader Service Card.

Magnesium Cleaner

A new cold magnesium cleaner and bright dip, Bernite BR4, has been developed by the Bernard Chemical Products Co. The powder mixed with water removes dirt, stains and surface oxides. It is an ideal preparation for welding.

Circle No. 216 on Reader Service Card.



Long Reach Spot Welder

A new machine capable of reaching a long way through small openings to weld stainless steel has been announced by Sciaky Bros., Inc. The machine will reach 150 inches into a 3- x 8-inch opening to weld blind. The offset electrodes have a maximum hydraulic pressure of 2,500 pounds. The 100 KVA transformer and single phase Dekatron controls act as a counter balance on the tubular welder carriage. The carriage moves in and out on anti-friction bearings.

Circle No. 217 on Reader Service Card.

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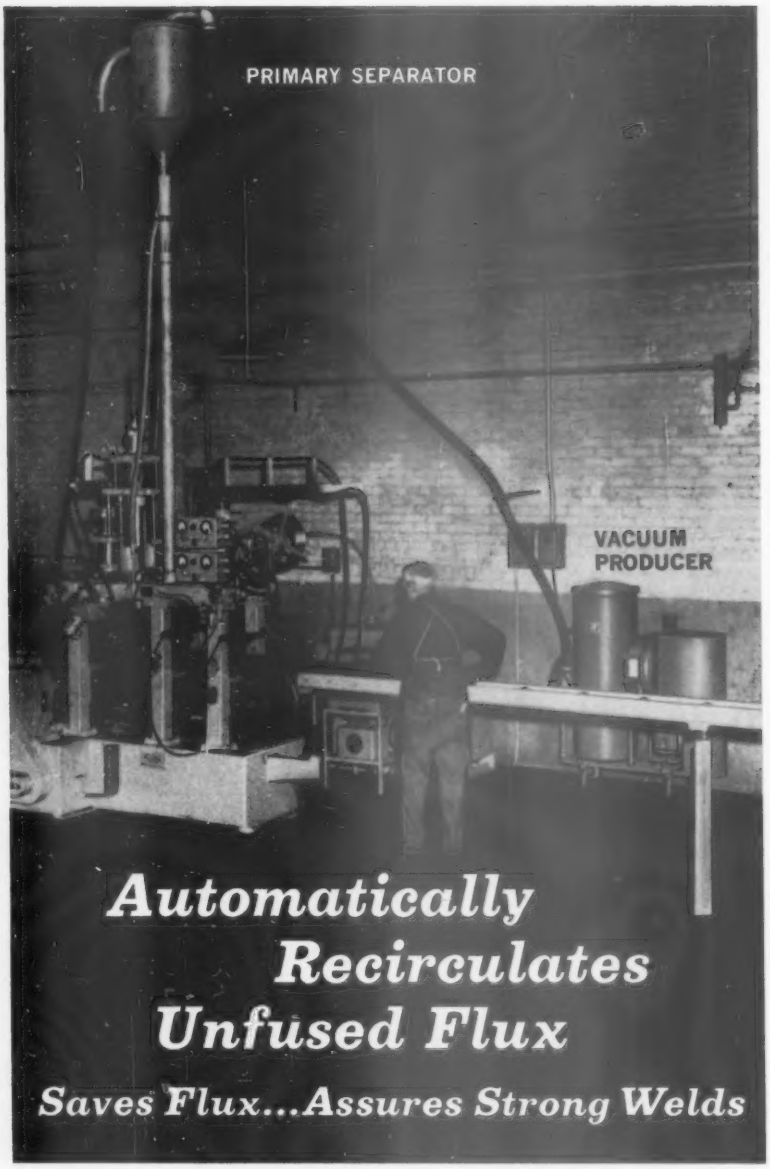

Automatically Recirculates Unfused Flux

Saves Flux...Assures Strong Welds

This Berkeley Continuous Seam Welder forms commercial angles into square welded tube at the rate of 80 inches per minute. The 5-horsepower Invincible Welding Flux Recovery System keeps pace by supplying a continuous flow of flux to the high speed welder.

The Invincible automatically recovers all unfused material. It removes powder and returns dust-free flux to the work in a non-stop operation. The results: Increased production. Absence of rejects. Strong, clean welds. And material savings that paid for the system in a few months.

With 14 standard models (1½ to 7½ H.P.), Invincible offers a system for virtually any submerged arc welding operation. Learn why Invincibles are the choice of welding fixture manufacturers — and users. Write us for a free survey of your operations. And . . .

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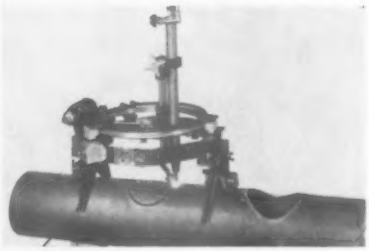

Flame Hole Cutter

Steffan Manufacturing Corp. has developed a machine for cutting 90° holes in pipe, tanks, and flat plates. The machine (Model ST) uses an oxy-acetylene torch to cut up to 18 inch diameter holes, and does it without cams, patterns, or layouts. The machine may be driven electrically (variable speed), or by hand.

Circle No. 218 on Reader Service Card.

Welding Goggles

Soft vinyl plastic welding goggles, that mold comfortably to the face, even over safety glasses, have been announced by Glendale Optical Co. Goggles (Type GW-400) feature: replaceable filter lenses, light-proof indirect ventilators, and vinyl noseguard.

Circle No. 219 on Reader Service Card.

Heat-Indicating Pellets

The Tempil Corp. has completed its 100°F to 3,000°F range of heat-indicating Pellets by adding 2,800°F, 2,900°F, and 3,000°F indicators. Tempil Pellets indicate heats within one percent accuracy.

Circle No. 220 on Reader Service Card.

Flow Indicator

The McIntosh Equipment Corp. has announced a new Arkon indicator that will show flow as low as 0.075 g.p.m. for water and 1/2 c.f.m. for gas. The only moving part is a nylon or teflon ball that dances in a toughened glass dome to show flow.

Circle No. 221 on Reader Service Card.

Welding Screen Has Handles

Spa-Fla wrap around welding screens, a product of Frommelt Industries, Inc., have been improved. They now have ruggedly constructed carrying handles which double as loops for hanging the screens. Screens come in seven sizes ranging from 18 by 36 inches to 72 by 108 inches.

Circle No. 39 on Reader Service Card.

Ultrasonic Testing Instrument

A nondestructive testing instrument, Model 424-D Immerscope, has been announced by the Princeton Division, Curtiss-Wright Corp. The Immerscope can be used to test such things as: plates, ingots, pipe, welds and other bonds, honeycomb, glass, rubber, and ceramics. The instrument's features include: high sensitivity, high-resolution contact testing, variable pulse repetition rate, and high speed flaw alarm.

Circle No. 222 on Reader Service Card.

Power Punch Press

A 25-ton power punch press, Model BT-25, has been announced by Alva Allen Industries. This press has a die space of 7-3/8 inches shut height, and an 8 inch throat. Die bed is 12 x 21 inches with 5- x 8-inch opening. Press will incline to 30°. Standard stroke is 2-1/2 inches; strokes of 1/4 to 4 inches are available. Requires 2 H.P. motor. Changes easily from repeat-stroke to single-stroke action.

Circle No. 168 on Reader Service Card.

Out-of-position Welding

A new welding electrode has been developed by A. O. Smith Corp. to deposit high-quality out-of-position welds. Called the SW 610, electrode has a coating that gives a uniformly flat bead, free from pits. The coating also improves arc direction and penetration.

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That's right—buy the whole package and you save $34.95! This is a complete "Purox" welding and cutting outfit that you can amortize in just a few jobs.

Sold separately, these components would list at a total price of $134.94—still a good buy, considering the top quality that "Purox" stands for. But with this "Four Nines" kit, you get a complete outfit for welding, cutting, heating, and brazing . . . all first-quality materials at a budget price. The "Four Nines" Outfit includes a welding torch with three heads, cutting attachment with one nozzle, oxygen and acetylene regulators, 12½ feet each of oxygen and acetylene hose with fittings, friction lighter, and goggles.

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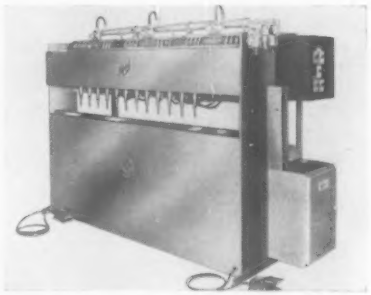


Multihead Spot Welder

A new multihead spot welder has been announced by the Alphil Spot Welder Mfg. Corp. Welder is available with 4, 8, or 12 heads which all come down at once but fire one after the other. Each head is adjustable, and has its own shut off valves and switches.

Circle No. 224 on Reader Service Card.

Welding Helmets

A new line of Oxweld welding helmets and handshields have been introduced by Linde Company, Division of Union Carbide Corp. The six helmelts come in three shell styles: straight, curved and narrow, either standard or lift-front glass-holders. Maximum comfort and perfect fit is provided from the sturdy plastic headgear. A complete line of filters, replacement parts, and accessories are available.

Circle No. 225 on Reader Service Card.

Power Sources

Two new welding power sources have been marketed by Air Reduction Sales Company. For manual and automatic gas-shielded metal-arc (Aircomatic) equipment, the welders put out constant arc voltage, or varying degrees of down slope. Units are rated at 300 amperes, 100% duty cycle; 500 amperes, 100% duty cycle.

Circle No. 226 on Reader Service Card.

Automatic Helmet

A welding helmet that allows the wearer to look at his work without lifting his helmet has been announced by Auto-View Welding Helmet Co. By opening his mouth, the operator switches from a filtered green to clear lens. He can switch back by closing his mouth. To keep the lens clear for a long period, he touches the button on the helmet and it stays clear until he opens his mouth again.

Circle No. 227 on Reader Service Card.

Line Regulator

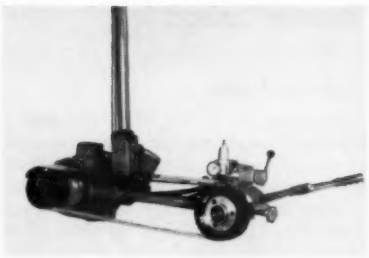
A new line of metering regulators, the L-40-AR series, for all common gases has been announced by the Harris Calorific Co. The regulators will give sensitive control of 0 to 100 cubic feet of gas per hour. All regulators have ¼ inch pipe thread inlets to prevent accidental mounting in high pressure cylinders.

Circle No. 228 on Reader Service Card.

Fume and Smoke Removal

A device for exhausting welding fumes and smoke, called Flex Air Mover, has been announced by Arcair Company. The unit has an intake nozzle which is joined to a jet pump by a length of flexible tubing. The unit uses compressed air, not electricity, for power.

Circle No. 229 on Reader Service Card.



Abrasive Belt Grinder

Grinding & Polishing Machine Corp. has added a medium-duty, abrasive-belt, swing-frame grinder to their line of equipment. The new units are available from 2 hp up, with air or spring tensioning. Belt sizes of 2 through 6 inches wide and 72 through 132 inches long are available.

Circle No. 230 on Reader Service Card.

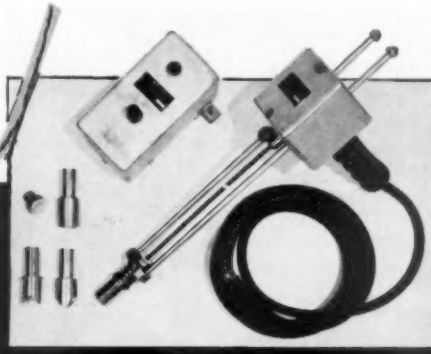
Tool Steel Welding Rod

A hot work tool steel rod has been developed by Welding Equipment & Supply Co. Called Eureka Super 88-A, rod is deposited by inert arc process, has a weld hardness of 55-56 Rockwell C. Available in 1/16, 3/32, 1/8, 5/32, and 3/16-inch diameters—in 36-inch lengths.

Circle No. 231 on Reader Service Card.

Now

The NO-ARC Electric Welding Gun that uses STANDARD ELECTRODES



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NO gas or water lines
NO special rods

No Other Gun Like it

Here's a shock-proof, fool-proof, labor-saving welding gun for shop or assembly line that spots or welds from one side. For welder or mechanic — **the only gun that bonds stainless or dissimilar metals using stainless steel or conventional steel electrodes.** The NO-ARC gun is easy to use . . . is rugged and dependable . . welds 30-gage or heavy plate without arc flash. Operates on AC or DC.

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Welding Lathe

Berkeley-Davis Inc. has developed a lathe for welding inside girth seams of rocket shells. Called Weldlathe unit has a long boom which carries the welding head for either MIG or TIG processes. The head will go through a 24-inch opening and weld the bottom of a 6-foot diameter shell or tank. Welding can be monitored with closed-circuit television.

Circle No. 232 on Reader Service Card.

Flowmeter Regulator

A new atmospherically heated flowmeter regulator for CO_2 is being marketed by Air Reduction Sales Co. The new regulator eliminates freeze-ups in flow control and the need for supplementary heat. Called CO_2 Solar Heated Flowmeter Regulator, unit expands high pressure CO_2 through two stages of pressure reduction. The two stages are connected by a heat exchanger coil.

Circle No. 233 on Reader Service Card.

Grinding Wheel Package

A new packaging system has been adopted by Bay State Abrasive Products Co. for their small grinding wheels. The new package is a clear plastic tube capped at both ends for easy opening. The tube is designed to simplify storage, inventory, and use of small wheels.

Circle No. 234 on Reader Service Card.

PROGRESSIVE IS FIRST WITH THE FINEST IN "JOB-ENGINEERED" RESISTANCE WELDING EQUIPMENT

Over twenty-five years of outstanding experience in the welding field makes Progressive your best bet for the finest resistance welding equipment and fixtures. A dependable part of the welding picture in almost every important manufacturing plant here and abroad, Progressive equipment has proved its quality and superiority right on the job.

Our engineers will gladly assist in the solution of your production problems.

Shown here are a few examples of Progressive's many types of equipment for every welding requirement.

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For More Information Circle No. 87 on Reader Service Card.

Resistance Heaters

Plug-in electrical-resistance heaters are manufactured by J. B. Nottingham & Co., Inc. Called Heatrol, units preheat, postheat, and stress relieve. They can heat metal to 1400°F and higher, and automatically hold at any level. The system has been successful in many applications.

Circle No. 235 on Reader Service Card.

Ignitrons

Coaxial welding ignitrons, developed by General Electric's Power Tube Dept., have anode and cathode terminals at the top of the tube. This eliminates the extension of the cathode terminal from the bottom. Bus bars, required with standard ignitrons in inverse parallel, aren't necessary. The newest G.E. coaxial ignitrons are the GL-7669, for size B welders, and the GL-7671, for size C welders. Both tubes are for 60 cycle use.

Circle No. 236 on Reader Service Card.

TIG Power Supply

A new type of balanced-wave power supply for high performance TIG welding has been developed by the Glenn Pacific Corp. Two models (BW 400-AC and BW 400-AC/DC) have three overlapping switch ranges, giving 28 to 400 amps on the 150-volt scale. The a.c./d.c. model is suited for all arc welding methods.

Circle No. 237 on Reader Service Card.

X-Ray Film Roll

Rolls of Kodak Industrial X-ray film, Type AA and M, are now available in a special type Ready Pack. The film is enclosed in light-tight, wrap-around package that can be cut to any length and resealed. The Ready Pack has 200 feet of film wound on a cardboard core, making a 12 inch roll. Film comes in 16, 35 and 70 mm widths.

Circle No. 31 on Reader Service Card.

TRIM COST OF WELDING STAINLESS

Remember: only Airco makes everything for Aircomatic®, Heliwelding, and stick electrode welding of stainless. Don't decide until you let Airco compare all 3 welding processes for your application.

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MODELS K3 & M2

BLOWTORCHES

Here are rugged, high efficiency blowtorches that speed up all types of heat treating and production operations. These two Clements Cadillac Blowtorches provide heat up to 2200°F, in seconds and are fully portable.

With the Clements Cadillac model K3 or M2 you can bring the torch to the work instead of the work to the torch as in fixed installations. Furnished fully equipped with 20 ft. of Underwriters' Laboratories and Canadian Standards Association approved 3-wire cable with plug, 10 ft. of gas hose with fittings ready to attach to your gas line and with sturdy, high stability stand. Easily adjustable for height and direction of torch.

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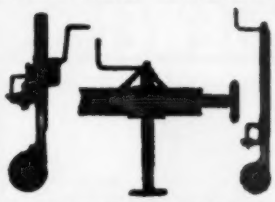
BULL DOG AXLE ASSEMBLIES

BULL DOG JACKS



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The JEWEL Angle Clamp holds branch line at right angles to the main or headers. Takes any size main or branch from ½" to 12".

The JEWEL Flange Clamp lines up the flange face at right angles to pipe end and holds until tacked. Takes sizes from 2½" to 16".

The JEWEL Pipe Clamp . . . aligns and holds pipe for tacking. Two sizes: ½" to 8" and 8" to 16". Sturdy construction for hard usage.

The JEWEL Elbow Clamp lines up welding elbows from 2½" to 8" at right angles to the pipe and holds them until tacked.

The JEWEL Pipe Marker marks a perfect hole and saddle on any pipe up to 20".

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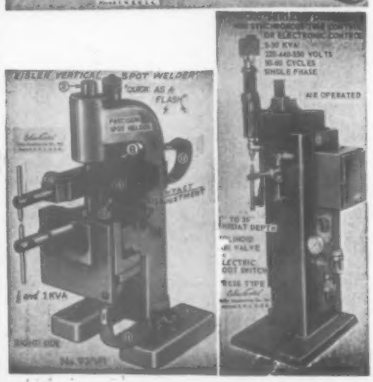
1841 University Ave., St. Paul 4, Minn.

Circle No. 57 on Reader Service Card.

EISLER makes the largest assortment of ELECTRIC SPOT, WIRE BUTT, SEAM, TWEEZER, GUN and FLASH WELDERS. We also carry in stock a variety of WELDING TIPS and ACCESSORIES.



EISLER ENGINEERING CO., INC.

735 So. 13th St., Newark 3, N.J.

Circle No. 32 on Reader Service Card.

NEW PRODUCTS *continued*

Electronic Line Tracer

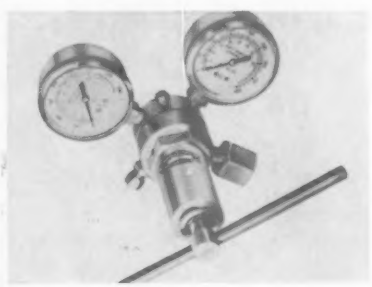
A new tracer suited for non-repeat flame cutting or for keeping template cost low is being marketed by Air Reduction Sales Co. Called Aircotron Model J, unit follows 0.020" to 0.040" pen or pencil lines made with conventional drafting methods. It has stepless speed control—5 to 24 ipm (more or less with a different motor)—and traces 90° corners without corner radii.

Circle No. 238 on Reader Service Card.

Liquefied Gas Pump

A light-weight liquefied gas pump has been announced by Paul Chemical Co., Subsidiary of Hofman Laboratories, Inc. The pump is 30 times lighter and 1/4 the size of equivalent units. Either motor driven or hydraulically operated units are available. Units pump from 2,000 scfh to 75,000 scfh of liquid to gas using either ambient air or water vaporizers.

Circle No. 239 on Reader Service Card.



High Pressure Regulator

The Harris Calorific Co. has announced the new No. XX-87 High Pressure Regulator which delivers up to 2,500 psi and has 4000/4000-pound gauges. The regulator was developed for hydrogenation, catalytic reduction, calerimetry, accelerated age-testing, and pressure testing.

Circle No. 240 on Reader Service Card.

Circle No. 9 on Reader Service Card.

ALVA ALLEN
Heavy Duty
PUNCH PRESSES

Powerful
Dependable and Economical
Fully Guaranteed

Moderate in Price

Hundreds of different Model Combinations 1 to 25 ton Capacities

Thousands in Use the World Over

Model BT-5 5-Ton Punch Press $199.50 less motor fob

See your Supply Dealer or write for catalog giving complete information, specifications and prices on our line of Heavy Duty Punch Presses.

See the yellow pages of your telephone directory for local distributor.

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TILLMAN
GLOVES-GARMENTS

WELDORS BUY FROM YOUR DEALER

WELDING GLOVES· MITTENS AND GARMENTS NOW IN POLY BAGS

BRAZILIAN DEERSKIN THE "STAY SOFT" LEATHER GLOVES AND MITTENS

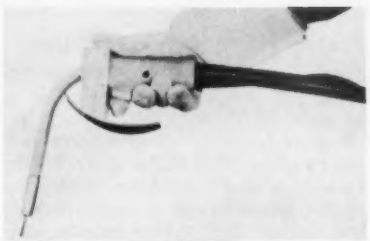
John Tillman & Company
1561 W. 19th St.
Long Beach, California

Circle No. 100 on Reader Service Card.

Metal Cut-off

A series of low-cost cutting machines for job shop or production cutting has been announced by Stone Machinery Co. Called the GR series, the machine is said to have maximum cutting speeds with long blade life on both traverse and chop-stroke models. Special steel blade cuts angle iron, bar stock, tubing, pipe, and shapes.

Circle No. 241 on Reader Service Card.



Semi-Automatic Welder

A new semi-automatic production welder for use on machinery and structural fabrication has been announced by Lincoln Electric Co. Called the Innershield Squirt Welder, unit constantly feeds a tubular, self-shielding electrode through a manual welding gun. A d.c. motor generator supplies 350 to 600 amps welding current. Cabinet contains current and voltage controls, electrode inch button, polarity switch, and electrode reel. The 24-ounce gun has a control trigger and a shield.

Circle No. 242 on Reader Service Card.

Boom Type Manipulator

The latest manipulator announced by the Pandjiris Weldment Co. is a welding-boom type. Min-O-Matic Controls at the operator's finger tips give him complete control of boom and welding. Along with the operator's seat and controls on the end of the boom are the welding power unit and flux recovery system.

Circle No. 243 on Reader Service Card.

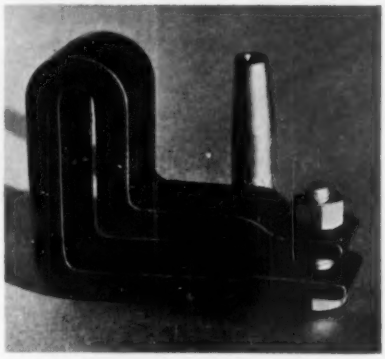
Safety Specs With Sideshields

Spectacles by Willson Products are available with five styles of sideshields. Called Monospecs, eye savers have one bridge size, adjust to 95% of wearers and nose pads that distribute weight for comfort. Sideshields are clear flesh or green plastic, with or without perforations, and plastic-bound 20-mesh wire screen.

Circle No. 244 on Reader Service Card.

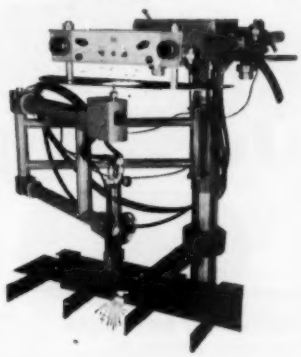
with a Heath Ultra-Graph

Cutting reduces short run costs



This clamp, designed to slide on 2"x2"x3/8" angle, illustrates the economy of controlled flame cutting. A Heath Ultra-Graph was used to cut a short run of clamps from 1" flat steel at less cost than possible by casting or machining. Using the angle as a pattern, light gauge metal strip was formed to the shape of the clamp. Tracing around this simple template, the Ultra-Graph cut each clamp in less than 3 minutes with clean sharp edges and a smooth surface finish. No additional finishing was required.

Factors that add up to savings: operating costs are low, fabricating time is short, cutting is of high quality, and flat steel never becomes obsolete inventory. Send now for more information on cost reduction with Ultra-Graph machines or see your Welding Supply Dealer for a demonstration.



HEATH ENGINEERING COMPANY

P. O. BOX 821
FORT COLLINS, COLORADO

Circle No. 51 on Reader Service Card.

flaw hunter

with this in hand

you find cracks and hidden surface flaws

in ✓ **metals**
in ✓ **plastics**
in ✓ **ceramics**
in ✓ **glass**
in ✓ *minutes*

USE **PIXchek** penetrant dye system for inspection after any metal-working process—casting, forging, welding, grinding, extruding, drawing, shearing—the gamut of operations. PIXchek is equally adaptable to single part or quantity-run inspection.

Everything you need is in this handy flaw-hunting kit

Sturdy steel hinged case with aerosol spray cans of PIXchek Dye, Cleaner, and Developer, plus extra cans of Dye and Cleaner for brush and wipe-on applications. The coupon below can start you flaw hunting right away.

$ only **35**

Picker x-ray

PICKER X-RAY CORPORATION
25 So. Broadway, White Plains, N. Y.

Please ship ☐ PIXchek Kits @ $35.00

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Purchase Order No._____

Circle 83 on Reader Service Card.

Tracer Floats Over Template

A flame cutting machine featuring cross roll drive is a development of Linde Company that eliminates electronic tracer drive-wheel contact with the template. This means that with the Oxweld CM-56 machine, protection of the template outline against scuffing and damage is unnecessary. CM-56 models can carry up to 8 torches and can be locked for straightline cutting.

Circle No. 245 on Reader Service Card.

Safety Hats Improved

A stronger, lighter, more comfortable suspension assembly is going into Boyer-Campbell Co. safety hats these days. The suspension has only three parts—sweatband, sizing band, and supporting crown; it's 30 percent lighter, and its fortified polyethylene resists ultra-violet damage.

Assembly fits size 6-1/2 to 8 heads and adjusts in three positions. It is featured in fibreglass and aluminum hats in many colors.

Circle No. 246 on Reader Service Card.

New Brazing Alloy Form

To promote speed and ease of application, Wall Colmonoy Corporation has introduced Nicrobraz alloys in a powder- and high-viscosity-vehicle mixture. Called the Nicrobraz S series, the new alloy forms apply with an air gun for production work or by syringe (shown) for smaller jobs. Application time is said to be cut in half with the new series.

Circle No. 247 on Reader Service Card.

Eliminates Spatter Grinding After Welding

YORK'S *SPAT-R-PRUF* COMPOUND 106

THREE *EASY* STEPS

1. Coat Surface
2. Weld
3. Wipe Off

A perfect paint base. No stirring or dilution necessary. No grinding after welding—spatter can be wiped away with a dry cloth.

IMPORTANT FEATURES

- Non Toxic
- Non Inflammable
- Pleasing Odor
- Harmless to Skin
- Helps Prevent Rust
- No Weld Porosity

Available in 1 gallon cans and 5 gallon cans and 55 gallon drums.

3-IN-1
YORK'S '77'
SPECIAL FLUX

- For General Brazing
- For Cast Iron Welding
- For Cast Iron Brazing

A guaranteed bond even under toughest conditions.
Available: 1 lb. Cans

YORK ENGINEERING COMPANY
2711 S. KEDZIE AVENUE • CHICAGO 23, ILLINOIS

For More Information Circle No. 109 on Reader Service Card.

Heavy-Duty Arc Welder

A new series of heavy-duty industrial arc welders for a.c. manual and automatic production welding is being marketed by Air Reduction Sales Co. Designated MCM-AC Bumblebee "S" Series, units come in 300 to 500 ampere sizes and have a 60 per cent duty cycle rating.

Circle No. 248 on Reader Service Card.

Portable Blast Cleaner

Trigger control is a feature of Bren Weld Corporation's new Model BC-1 blast cleaner. Unit weighs 25 lb., stands 20 inches high, and holds 50 lb. of sand. Its continuous feed of abrasive during blasting provides efficient, economic cleaning of weldments, metallized parts, and others.

Circle No. 249 on Reader Service Card.

Automatic Hose Reel

United Specialties, Inc. has developed Model A-3 Reel-King with capacity for 25 feet of 3/8- or 1/4-inch single hose. They recommend the spring-operated unit for suspended air guns, tools, water clean-up hoses, paint booths, and test- and work-bench hose. Drum locks for 170° of each turn, easily reverses with a tug on the hose. Reel eliminates fumbling and untangling and stores hose safely when not in use. Ruggedly built, smooth working, easily maintained.

Circle No. 250 on Reader Service Card.

Circle No. 84 on Reader Service Card.

product defects

getting you down?

let us help you...

- ***find hidden cracks*** with magnetic particle or dye penetrant inspection equipment
- ***find deep-lying defects*** with x-ray or gamma radiography equipment
- ***see "innards" directly*** with bright-image fluoroscopes
- ***work out the method*** at our Industrial Applications Lab

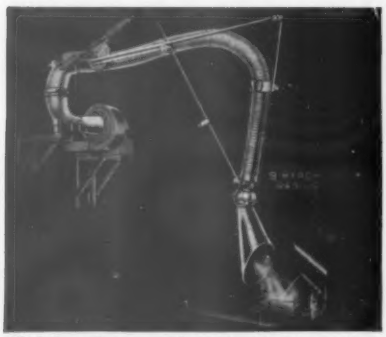
call any local Picker office

where a technical expert is always near (see 'phone book) or write

Picker x-ray

25 So. Broadway, White Plains, N.Y.

Remove Welding Fumes at the Source... with RUEMELIN FUME COLLECTOR



Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed.

Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle.

WRITE FOR DETAILED INFORMATION

RUEMELIN MFG. CO.

3932 N. PALMER STREET • MILWAUKEE 12, WIS., U.S.A.

Mfrs. & Engineers • Sand Blast & Dust Collecting Equipment

Circle No. 90 on Reader Service Card.

NEW from **GLENDALE**

No. GW600

Unisite Welding Goggle

The only WELDING GOGGLE ever designed to carry a magnifier

- Construction permits Supersite Magnifier to snap securely into place behind filter lens without use of tools or fuss.
- Soft construction.
- Single plate construction. Light-proof, baffled, air-conditioned.
- Adjustable Nylon headband.
- Exclusive bellows (or pleated construction permits universal fit.
- Lightweight and comfortable.

Visit BOOTH 507
April 18-19-20, New York Coliseum

Write for new 1961 catalog

Full details and specifications on request.

GLENDALE OPTICAL CO., Inc.

600 W. MERRICK ROAD, VALLEY STREAM, N.Y.

• S-7 SPECTACLES & LENSES • FACE SHIELDS • WELDER'S AND CHIPPER'S GOGGLES • DUST GOGGLES • ACID & CHEMICAL GOGGLES • FLASH SPECTACLES • PLASTIC EYESHIELDS • CHIPPING & GRINDING SPECTACLES • WELDING PLATES & LENSES

For More Information Circle No. 43 on Reader Service Card.

Circle No. 85 on Reader Service Card.

product defects

getting you down?

buck up . . .

x- or gamma radiography
can find internal defects

magnetic particle or dye penetrant inspection
can find hidden cracks

bright-image fluoroscopy
lets you see "innards"

let us test for your best bet
at our Industrial Applications Lab

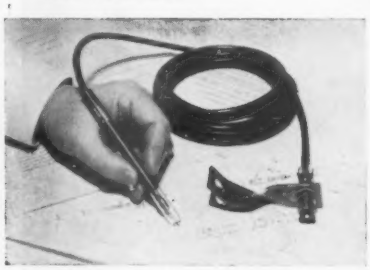
call any local Picker office
where a technical expert is always near
(see 'phone book) or write

Picker x-ray

25 So. Broadway, White Plains, N.Y.

Could you use . . .

A Pencil-Type Pencil-Size TIG Torch for your precision weldments!



Actually, our 1-ounce Model B Argopen is small enough to be gripped and manipulated like a ball point pen. Our customers particularly like the propel-repel collet and co-axial power cable hose. The present user net price complete with cable adaptor and instructions is $25.00.

Write us or see your dealer for details.

The Argopen Co.

207 Allen Rd. N. Syracuse 12, N.Y.

Circle No. 112 on Reader Service Card.

NEW PRODUCTS *continued*

Weld Viewer

Airline Welding And Engineering has developed two Shield-All Weld Viewers that eliminate the need of a welding hood, yet give the operator a good visibility.

Model WH6B (top) has a flip-front for natural viewing. A 6X magnifier can enable the operator to follow welding with low amperages on thin material. Model WH 11 (bottom) has a large (4 by 5 inch) viewing area. Both models have pliable leather skirts which hug the work and protect the operator.

Circle No. 251 on Reader Service Card.

Heating Torch

The High-Blast Torch, announced by the Bryant Industrial Products Corp., can be used for heat treating, soldering, brazing, and preheating for welding. It uses shop air and any low-pressure commercial gas. It produces a hard, sharp, clear blue high-blast flame. Torch comes in 8 sizes with heat capacity ranging from 40,000 to 3,000,000 BTU-hour.

Circle No. 252 on Reader Service Card.

Air-Powered Nibbler

A new tool for heavy-duty cutting of 1/4-inch steel, 8-gage stainless, and 5/16-inch aluminum has been announced by Fenway Machine Co. Designated Model EAN, unit weighs 18-1/2 lb., cuts down to 8-inch circles, and has been clocked at 45 ipm. The EAN has anti-friction bearings. In cutting, chips go down and away from the operator.

Circle No. 37 on Reader Service Card.

Circle No. 23 on Reader Service Card.

BECKER Keen-Cut Electrodes for use in

CARBON ARC-AIR JET GOUGING

KEEN-CUTS—for the best characteristics of carbon and graphite in a carbon arc cutting electrode. Higher current capacity . . . longer life . . . shorter cutting time . . . greater material removal . . . smooth surface gouge . . . controllable accuracy . . . hot stable cutting arc . . . elimination of smoke and gases.

And they're low in cost. Try BECKER KEEN-CUT ELECTRODES—black or copper coated, standard diameters, 12" lengths in 150 to 1400 amp. range—for the most efficient, labor-saving electrode in carbon arc/compressed air cutting.

A COMPLETE LINE OF CARBON AND GRAPHITE WELDING SUPPLIES—carbon and graphite electrodes, carbon rods and plates, welding paste, graphite cores and chills, graphite powder and particles of any mesh.

Write for Catalog

BECKER BROTHERS CARBON CO.

3442 South Laramie Ave.
CICERO 50, ILLINOIS

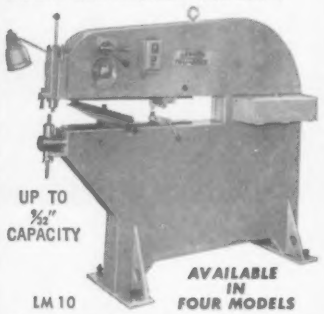
MORE FOR YOUR MONEY— AND "AMERICAN-MADE" TOO!

LENNOX TRU-EDGE® METLMASTR

Shearing • Forming • Piercing

5 MACHINES IN ONE

Before you buy — compare feature for feature the American-Made METLMASTR against all others — then compare also what this versatile metalworking machine costs you. The Lennox Tru-Edge METLMASTR is the only machine of its kind "Made in America by American Workers with American Know-how"!



UP TO 5/32" CAPACITY

LM 10

AVAILABLE IN FOUR MODELS

Write today for complete information on Lennox Tru-Edge METLMASTRS — Profitwise, you'll be glad you did.

LENNOX

TOOL and MACHINE BUILDERS

653 North Baxter St. • Lima, Ohio

Circle No. 62 on Reader Service Card.

Dust Masks

Packaged in a compact, ten-unit, color-coded carton for easy stacking and cleaner handling are low cost, lightweight No. 36 masks manufactured by Dockson Corporation.

Masks are pliable aluminum which fit closely around mouth and nose contours. Inexpensive, throw-away, sterilized cotton gauze filters are held snugly against the face, filtering dirt particles from the air, but allowing free breathing and clear speech.

Circle No. 253 on Reader Service Card.

Connection of Many Uses

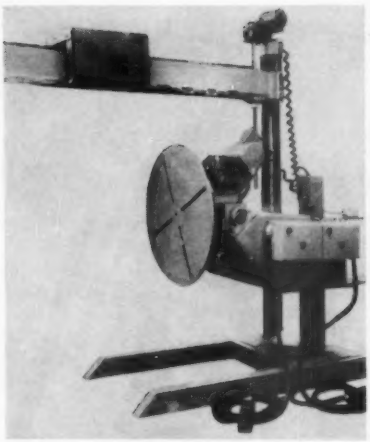
The Bastian-Blessing Company has introduced a multi-purpose tee connection for portable extendable manifolds. The 13000 Series manifold cylinders economically for portable or temporary use. Tees may also be used to connect two regulators to a single cylinder.

Circle No. 348 on Reader Service Card.

Speed Flux

A development of Farrelloy Company for high speed continuous tube and automatic soldering lines, Mayolyte, has been perfected for general use.

Circle No. 351 on Reader Service Card.



Boom Carriage Fits Positioners

Adaptable to any Unique Equipment, Inc. positioner is the company's new welding boom carriage equipment. The beam and carriage is set off from the center of the positioner to allow for longitudinal as well as circumferential welding. The welding head tip is in perfect alignment with the center of the positioner.

Circle No. 347 on Reader Service Card.

FIRST Completely Automatic Spot Weld Gun

SPOT WELDS FROM ONE SIDE

ELIMINATES THE NEED
FOR DRILLING, TAPPING
OR RIVETING

- AUTOMATIC FEED • AUTOMATIC TIME CONTROL
- REQUIRES NO RESETTING

Can be operated as fast as desired merely by pressing against the work. No triggers, knobs or reset buttons to slow up the operator. Wt.: 2½ lbs. Finish: Polished Aluminum.

The Model 90 AUTO-SPOT Weld Gun is designed to operate from the Model 90 AUTO-SPOT POWER PAC.

Operates on 110-220 volts. Other voltages available on special order.

Model 90

BREN WELD
WELDING EQUIPMENT
5114 THIRD AVENUE
BROOKLYN 20, N.Y.

For More Information Circle No. 25 on Reader Service Card.

BIG BIG

The curtain's going up, April 18-20 in the New York Coliseum, on a brand new era of increased profits from the sale of acetylene gas. It's the **BIGGEST** profit-making advancement since Coyne Cylinder Company first introduced the Coyne "92" high-porosity filler. **NOW...FOR ANOTHER FIRST** Coyne brings you the industry's highest porosity filler in the industry's **BIGGEST** capacity acetylene cylinder.

COYNE

1,000 CU. FT. CAPACITY

ACETYLENE CYLINDER

Pre-viewed at the show

BOOTH 228

COYNE CYLINDER COMPANY

Division of
AMERICAN CRYOGENICS, INC.

224 Ryan Way, So. San Francisco, California
155 W. Bodley Ave., Memphis, Tennessee
3800 Springdale Ave., Glenview, Illinois

Circle No. 30 on Reader Service Card.

For More Information Circle No. 21 on Reader Service Card.

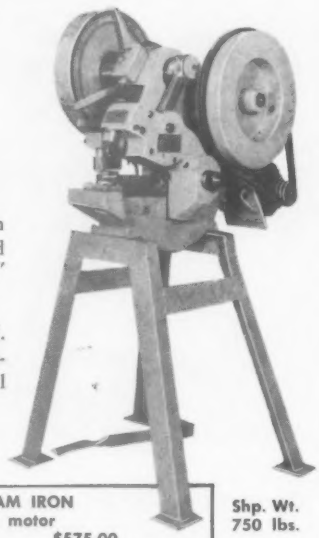
Large and Small Fabricators of steel and ornamental iron swear by it ...

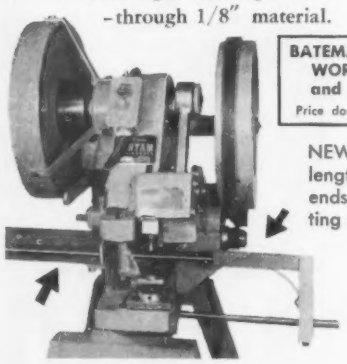
BATEMAN BANTAM IRON WORKER

The Bantam cuts and punches fast and clean . . . no grinding necessary. It's versatile, and saves time and labor! Cuts 2" x 2" x 1/4" angle and 1/4" x 4" flats.

Punches 1/2" hole through 1/4" material. Operates by hand or foot, uses 3/4 hp motor (1750) rpm., powered with flywheel and drive gear.

The Coper will cope 1-1/4" -through 1/8" material.





BATEMAN BANTAM IRON WORKER, with motor and stand $575.00
Price does not include Blades, Punches or dies.

Shp. Wt. 750 lbs.

NEW ACCESSORIES: Gauge for cutting to length, Guide for Flat Bars for cutting on ends, and Angle Iron Trimming Guide, for cutting at a 45 degree. Write for details.

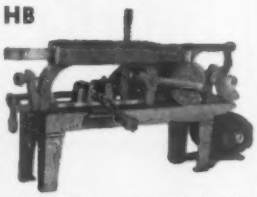
WRITE TODAY for complete information and name of nearest distributor

Bateman Foundry & Machine
MINERAL WELLS, TEXAS

KELLER *POWER* HACK SAWS

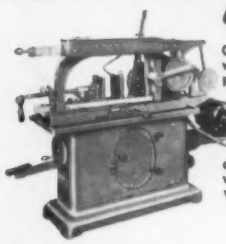
Cut Cutting Costs

MODEL 1 HB
5" x 5"



A rugged bench saw with cast base and legs, 45° swivel vise, 2 speeds, Oilite bearings, adjustable bronze bearings in saw frame. Complete with 1/3 h.p., 110 V. motor, switch, wired ready to go. Also available in floor model, No. 1 HF.

MODEL 3CH WET CUT
6¾" x 6¾"



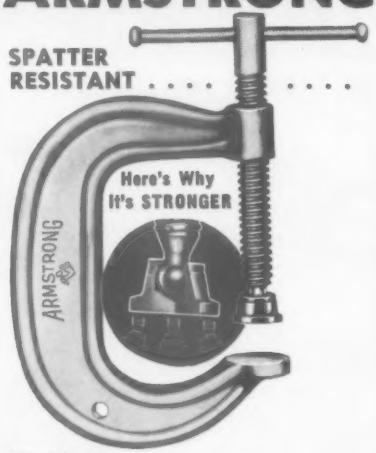
Cast cabinet base with built-in coolant pump & tank, foot lift to saw frame, automatic lift on back stroke, feed pressure control, complete with motor, switch, wired ready to go.

KELLER Power Hacksaws are built in 5 sizes, 10 models. Ask your Welding Equipment Distributor or write for details.

Sales Service Mfg. Co.
2365 University Ave., St. Paul 14P, Minnesota
Circle No. 91 on Reader Service Card.

ARMSTRONG

SPATTER RESISTANT . . . .

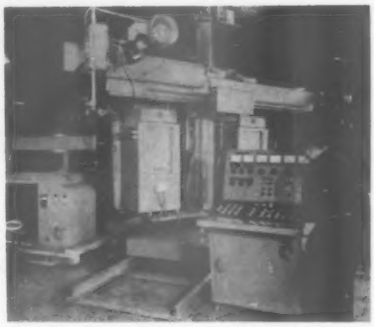


Welder's
C-CLAMP with the New Ball-joint Swivel Pad
that can't come off

These finest welder's clamps have every quality and convenience feature: Extra deep throat. Extra stiffness and strength—drop forged steel, heat treated. Cadmium plated *all over*—spatter resistant. Drilled for ground. And, the exclusive, ARMSTRONG 1-piece, formed-on swivel pad that can't work, pry or knock off. 8 sizes: capacities to 12" opening. Specify ARMSTRONG Spatter Resistant Welder's "C" Clamps for safe, lifetime service. There are no better.

Write for Catalog

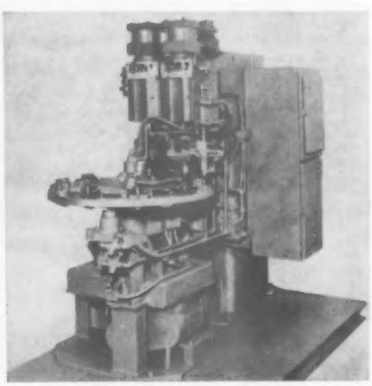
Armstrong Bros. Tool Co.
5262 West Armstrong Ave. • Chicago 46, Ill.
Circle No. 19 on Reader Service Card.



Laboratory Welder

The C. B. Herrick Mfg. Co. has developed a completely automatic welding unit for research, experimental and development use. It consists of a heavy duty ram type manipulator mounted on variable speed travel carrage, Airline longitudinal seam welding fixture, Airline circumferential welding fixture, complete welding equipment for MIG, TIG, and submerged arc welding, six channel recorder, and control console. Welding head has 6 feet vertical adjustment, 9 feet horizontal variable speed ram travel, and 360° horizontal rotation. The welding heads on either end of the ram can be positioned over a seamer, fixture, or turning rolls.

Circle No. 352 on Reader Service Card.



Dial Indexing Welder

One of the special welding machines built by Acro Welder Mfg. Co. is a machine for pilot production of ball bearing conveyor wheels. Unit has two 75 kva, 2,300 lb. electrode force press welding heads in series welding circuit. Projection welds two wheels at a time. It also has three hopper orientating bowl and track and transfer units for automatically loading the six balls and cup comprising each wheel assembly.

Circle No. 353 on Reader Service Card.

Circle No. 16 on Reader Service Card.

IT'S NEW: SO HANDY

Economical Too

NEW "ROYAL" HARDENING POWDER

In the Shaker Can

"ROYAL" HARDENING POWDER is safe to use. No Toxic fumes. Hardens low-carbon steels equally as well as cyanides.

- So easy to use now. Just sprinkle "ROYAL" on heated edge of Tool, Plow Share or other articles to be hardened. Let "ROYAL" liquidize in heat.
- Remove, clean and quench in regular manner.
- Enables the weldor or blacksmith to produce a finer cutting tool with longer life, without expensive equipment.
- Produces a .01 to .02 in. case depth with necessary Brinnell toughness on large or small low-carbon steel tools or parts.

Send for free sample and literature

Manufactured Only By
ANTI-BORAX COMPOUND CO., INC.
FORT WAYNE, INDIANA

NEW SINGER SAFETY SHIELD

In the plant or on the job

★ LIGHTWEIGHT ★ RUST-PROOF
★ LOW COST ★ FIRE-RESISTANT
★ ASSEMBLED OR TAKEN APART IN MINUTES WITHOUT TOOLS

Just think of it—no hooks, no bolts, no screws. Ideal for welding, grinding, machining etc. or can be used straight line as a protecting divider. Rust-proof steel frame with heavy fire-resistant duck curtain—attaches in seconds with with heavy duty snap fasteners.

In 4 standard sizes:
18" x 42", 36" x 48", 36" x 60", 36" x 72"

NEW BIG CATALOG
Describes screens in detail. Complete line of work gloves, welding gloves and safety clothing.

Ask your dealer or write:
Special Products Division
SINGER GLOVE MFG. CO.
860 W. WEED St.,
CHICAGO 22, ILL.

BOOTH NO. 101—WELDING SHOW
Circle No. 92 on Reader Service Card.

Leak Detector

A new helium detector that permits quick location of leaks in tanks, piping, and other fittings, has been announced by Industrial Instruments, Inc. A 2-range feature permits high sensitivity pick-up of small leaks while minimizing overdrive of the meter on large leaks. The thermal conductivity sensitivity detector is powered with mercury cells.

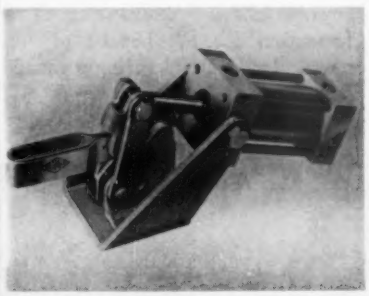
Called Therma Bridge, leak detector comes in two models, one with a hand pump, the other with an electrical pump. Unit can be calibrated for other gases.

Circle No. 349 on Reader Service Card.

Liquid Gas Transports

Vessels for transporting liquid oxygen and liquid nitrogen in 500-to 4,000-gallon capacities are being built by Hofman Laboratories, Inc. Trucks feature rugged construction and powder-in-vacuum insulation to assure low loss. Standard: bottom fill and discharge, top fill, liquid level gauge, thermocouple vacuum gauge, pressure gauge, complete safety equipment, and others.

Circle No. 54 on Reader Service Card.



Air-Hydraulic Toggle Clamps

Detroit Stamping Company has announced a new series of recoiless toggle clamps designed for hard-to-reach jobs and for rapid sequence of light assembly work. Clamps have a 450-lb. hold at 80 lb. line pressure. Come with solid bar and spindle retainer, standard U-bar, and long U-bar. Cylinders on this (807) series are double-acting with a 1 7/8-inch stroke.

Circle No. 350 on Reader Service Card.

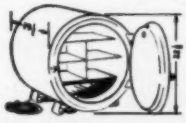
"They go Together"

low hydrogen electrodes high moisture

END THIS COSTLY AFFAIR BY KEEPING YOUR RODS AT HOME
in
PHOENIX DryRod®
ELECTRODE OVENS

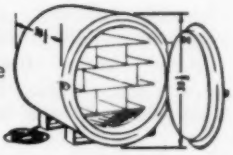
Pioneer and Leader in the Field

Dry Rod is the Trademark of Good welding everywhere



TYPE 300
350 lb size

TYPE 900
1100 lb size



TYPE 10
Portable
10 lb size

Also available:
Type 1000 (800° or 1000°)
High temperature
Re-baking ovens

Welding electrodes are a perishable product. Reworks are extremely costly. Insure good welds with Dry Rod Ovens. Write for folder "Dry Rod as Standard Welding Equipment".

PHOENIX PRODUCTS COMPANY
4715 N. 27th Street • Milwaukee 9, Wis.

Circle No. 82 on Reader Service Card.

DISTRIBUTION PLANS are discussed by L. W. Stettner, president of Victor Equipment Co., with R. T. Brown, general manager of Metal & Thermit's Welding Products Division. Victor, with headquarters in San Francisco, will distribute M&T's Murex line of welding electrodes, machines, and accessories, in the Southern California area.

COMING EVENTS

April 11-12, 1961: National Association of Industrial Glove Distributors, Spring Meeting, Statler-Hilton Hotel, New York City.

April 17-21, 1961: American Welding Society Convention and Welding Exposition, Commodore Hotel and New York Coliseum, New York City.

April 24-25, 1961: International Acetylene Convention, Sheraton-Plaza Hotel, Boston.

May 8-10, 1961: National Welding Supply Association Convention, New York City.

May 22-25: Design Engineering Conference, Cobo Hall, Detroit.

July 18-20: Western Plant Maintenance and Engineering Show & Conference, Pan Pacific Auditorium, Los Angeles.

New Distributors And Sales Representatives

Elgin National Watch Co. (Abrasives Division), Elgin, Illinois: R. F. Cook Mfg. Co., Cuyahoga Falls, Ohio; Janco Industrial, Rockford, Illinois; Harris Pump and Supply, Pittsburgh; J. Kelly Company, Cincinnati; Noland Company, Inc., Birmingham, Alabama; Standard Die Supply of Kentucky, Louisville.

Messer Cutting Machines, Inc. New York City: Edward A. Lynch Machinery Co., Inc., Wynnewood, Pa.

Unique Equipment, Inc., Brooklyn: Jaeger Welding Supply Co., Springfield, Mass.

United Specialities, Inc., El Dorado, Arkansas: Incorporated Sales Industries, Houston.

Vacuum Tube Products Division, Hughes Aircraft Company, Oceanside, Calif.: Brooks, Feeger & Associates, Albuquerque, N. M.

ABOUT RWMA

continued from page 16

Consistent with its purpose to sponsor activities of benefit to its members and industry, FWMA several years ago began preparation of a Third Edition of the Resistance Welding Manual. Volume I, covering processing and materials, was published in 1956 and has had industry-wide acceptance as a manual for the fundamentals of resistance welding. Volume II, covering equipment, will be published this year.

Our aim is to develop and present standards for resistance welding and resistance welding machines, to provide recommendations in the use of this fabrication process, and to encourage dissemination of such information for the benefit of engineers, plant manufacturing personnel, instructors and students. • •

TECHNICAL SERVICE TO CUSTOMERS is being broadened by Air Reduction Sales Company's electrode welding school at the company's electrode and wire manufacturing plant in Sparrows Point, Md. The school is a training program for Airco salesmen and technical representatives. Week-long courses cover electrode operating characteristics and procedures for determining type and size of electrode to meet various application requirements.

Circle No. 52 on Reader Service Card.

"What's the secret of your strength, HERCULES?"
"No secret – I use only virgin alloys in my spotwelding tips and machine them with the best equipment money can buy."

Resistance Welding Alloys our only product. An abundant inventory of spotwelding tips and related accessories, as well as the various grades of copper-alloy bar stock, maintained at all times.

tips—holders—wheels—copper alloy bar stock, forgings and castings

Catalog Available On Request

HERCULES WELDING PRODUCTS CO.
11478 Timken Ave., Warren, Michigan
JEfferson 9-2610

IN 1936, MORT CLARK, then Vice-President of the world's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding Foundation—and

'MORT CLARK'S GALV-WELD ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959—23 YEARS LATER!

TIME PROVEN — MODESTLY PRICED
WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

Some distributor franchises still available. Cash in on consistent campaign now running in 18 national magazines.

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Send Information User ☐ Distributor ☐
Dealer ☐ Free Sample ☐

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Address .....
City ..... State .....

Circle No. 41 on Reader Service Card.

Data Offered in This Month's Ads

Readers may obtain any of these free reference materials by circling the corresponding numbers on the Reader Service Cards

1: Hard surfacing catalog is offered. **The McKay Co.**

2: Welding of stainless steel is featured in new catalog. **Glendale Optical Co., Inc.** literature. **McKay Co.**

3: Welding mild and low alloy steel is featured in literature. **McKay Co.**

4: Stainless welding is featured. **Air Reduction Sales Co.**

5: Metal-to-metal surfacing is featured. **Air Reduction Sales Co.**

6: Resistance welding bent tips are featured in a catalog. **Air Reduction Sales Co., Tuffaloy Dept.**

7: Brazing instruction manual is offered **All State Welding Alloys Co., Inc.**

8: Welding platens are described in literature. **Acorn Iron & Supply Co.**

9: Punch presses are featured. **Alva Allen Industries.**

10: Brazing alloys are listed in catalog. **American Brazing Alloys Corp.**

11: Resistance welding tips are featured. **American Metal Climax, Inc.**

12: Goggles that fit over glasses are featured. **American Optical Co.**

13: Silver Brazing is subject of booklet. **American Platinum & Silver Div., Engelhard Industries.**

14: Beveler for small pieces is illustrated in literature. **American Pullmax Co., Inc.**

15: Resistance welding electrodes for high temperature use are the subject of catalog. **Ampco Metal, Inc.**

16: Hardening powder sample is offered. **Anti-Borax Compound Co., Inc.**

17: Stainless electrodes are featured. **Arcos Corp.**

18: Filler metals of a complete line are featured. **Arcos Corp.**

19: Hold-down clamps are featured. **Armstrong Bros. Tool Co.**

20: Weld cleaning tools are featured. **Atlas Welding Accessories Inc.**

21: Iron workers and accessories are described in literature. **Bateman Foundry & Machine.**

22: Reinforced Resinoid disc-wheels are discussed. **Bay State Abrasive Products Co.**

23: Carbon arc gouging is featured in material. **Becker Brothers Carbon Co.**

24: Ultrasonic weld inspection is featured. **Branson Industries Inc.**

25: Automatic spot weld gun is described. **Bren Weld Corp.**

26: Power connectors are described in catalog. **Cam-Lok Div., Empire Products, Inc.**

27: Welding helmets with detachable neoprene lens are featured. **Chicago Eye Shield.**

28: Press brakes are described in Catalog No. 2010. **Cleveland Crane & Eng. Co.**

29: Pipe layout equipment is featured. **Contour Sales Corp.**

30: Largest capacity acetylene cylinder is featured. **Coyne Cylinder Co.**

31: X-ray film pack in rolls is described. **Eastman Kodak Co., X-ray Sales Div.**

32: Welding tips and spot welding equipment are shown. **Eisler Engineering Co., Inc.**

33: Induction heaters are described in brochure. **Electric Arc, Inc.**

34: Exhaust systems of all sizes and for all purposes are listed. **Engwald Co.**

35: Arc welding accessories in the welding circuit are discussed. **Erico Products, Inc.**

36: Controlled angle torch for tungsten inert gas arc welding is described in catalog. **Falstrom Co.**

37: Portable nibblers are described in literature. **Fenway Machine Co., Inc.**

38: Welding helmets and accessories are featured. **Fibre-Metal Products Co.**

39: Welding screens and enclosures are shown. **Frommelt Industries, Inc.**

41: Galvanizing small parts and weldments is described in literature. **Galv-Weld Products.**

42: Annealed tungsten electrodes are described. **General Electric Co., Lamp Metals & Components Dept.**

43: Eye safety equipment is featured in a new catalog. **Glendale Optical Co., Inc.**

44: Brazing flux and its characteristics are explained. **Goldsmith Brothers.**

45: Extra strength alloy steels are featured. **Great Lakes Steel.**

46: Portable sandblaster is featured. **Hamill Mfg. Co., Inc., Handi-Blast Div.**

47: Axle assemblies, jacks, couplers, and spindles are illustrated in a catalog. **Hammer Blow Tool Co.**

48: Silver brazing details are contained in a booklet. **Handy & Harman.**

49: Welding equipment is listed in a catalog. **Harnischfeger Corp.**

50: Cutting torches and tips and gaugeless regulators are shown. **Harris Calorific Co.**

51: Controlled flame cutting is described in literature. **Heath Engineering Co.**

52: Resistance welding alloys and tips are featured. **Hercules Welding Products.**

53: AC welder for production use is described in bulletin. **Hobart Brothers Co.**

54: Liquefied gas storage and transport vessels are featured. **Hofman Labs., Inc.**

55: Flux recovery equipment is featured. **Invincible Vacuum Cleaner Mfg. Co.**

56: Welding and safety equipment is listed in a catalog. **Jackson Products.**

57: Clamps for various uses are described in literature. **Jewel Manufacturing Co.**

58: Metal cutting band saw is described in literature. **Johnson Manufacturing Corp.**

61: Electrode holders for all manual arc welding are described. **Lenco, Inc.**

62: Shearing, forming, and piercing machine is featured in literature. **Lennox Tool and Machine Builders.**

63: Manipulators for all jobs are described. **Lewis Welding & Engineering Corp.**

64: Fully automatic INNERSHIELD is described. **Lincoln Electric Co.**

65: Portable sandblast gun is described. **Lindberg Products Co.**

66: Welding distributors and how they serve local needs is described. **Linde Co.**

67: Welding and cutting outfit is featured. **Linde Co.**

68: One welder for spray arc, short arc, and spot welding is featured. **Linde Co.**

69: Resistance welding component distributors are listed. **P. R. Mallory & Co., Inc.**

70: Temperature indicators in adjustable holders are described. **Markal Co.**

72: Lifting clamps and attachments are described in catalog C-3. **Merrill Bros.**

73: Rebuilding and salvaging is described. **Metallizing Company of America.**

74: Flame spraying hard facing is described in a bulletin. **Metco, Inc.**

75: Mig welding with any shielding gas is described. **Miller Electric Mfg. Co.**

76: Portable elestric tools are featured. **Milwaukee Electric Tool Corp.**

77: Welding gun that spots and welds from one side is described in bulletin WD-4. **No-Arc Equipment Co.**

78: Shape cutting is featured. **Ohmstede Machine Works Inc.**

79: Mig spot welding techniques are featured. **Olin Mathison, Aluminum Div.**

81: Positioners and manipulators are featured. **Pandjiris Weldment Co.**

82: Electrode ovens are subject of folder. **Phoenix Products Co.**

83: Flaw-hunting kit is featured. **Picker X-ray Corp.**

84: Finding defects is discussed. **Picker X-ray Corp.**

85: Non-destructive testing is featured. **Picker X-ray Corp.**

86: Compressed gas cylinders are listed in a catalog. **Pressed Steel Tank Co.**

87: Resistance welding equipment is featured. **Progressive Welder and Machine Co.**

88: Hard facing electrodes are described. **Rankin Manufacturing Co.**

89: Rebuilding worn parts is featured. **Rexarc, Inc.**

90: Welding fume removal is described in literature. **Rumelin Mfg. Co.**

91: Power hacksaws are featured. **Sales Service Manufacturing Co.**

92: Safety screens, gloves, and safety clothes are featured in a catalog. **Singer Glove Mfg. Co.**

93: Button welding is described in Bulletin MW-253. **A. O. Smith Corp.**

94: Oxy-acetylene and oxy-LP gas flame traits are shown on a chart. **Smith Welding Equipment Corp.**

95: Transistorized welder control is described. **Square D Company.**

96: Fabrications of all types are available. **Steel Fabricators Co.**

97: Miniature torches are featured. **Tec Torch Co., Inc.**

98: Temperature indicating crayons are the subject of literature. **Tempil Corp.**

99: Lens covers of plastic are featured. **Thermacote Co.**

continued on page 124

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continued from page 123

100: Gloves and garments for welding are described. **John Tillman & Co.**

101: Electrodes for resistance welding are listed in a catalog. **Tipaloy, Inc.**

102: AC-DC 3-phase arc welder is featured. **Vickers Inc.**

103: Welding/cutting units are described in literature. **Victor Equipment Co.**

106: Cutting torch and attachment are described in literature. **Weldit Inc.**

107: Helmets with interchangeable front frames are featured. **Welsh Mfg. Co.**

108: Radiographic inspection of steel up to 4" is described in literature. **Westinghouse Electric Corp., X-ray Dept.**

109: Special flux eliminates grinding. **York Engineering Co.**

110: Blowtorches which operate on natural, manufactured, or LP gas are described. **Clements Mfg. Co.**

111: Oxide scale problems are discussed in a bulletin. **Chemclean Products Corp.**

112: Miniature Tig torch is described in literature. **Argopen Co.**

113: Positioners of a complete line are featured. **Aronson Machine Co., Inc.**

150: Micro-Matic bulletin is offered. **McKay Co.**

151: Multi-Matic bulletin is offered. **McKay Co.**

152: Track-O-Matic bulletin is offered. **McKay Co.**

CLASSIFIED

Cost of all ads in this section is $20 for the first inch and $15 for each additional inch or fraction. Rates for display ads in this section will be sent on request. All classified advertising payable in advance.

WELDING TRAINING

Complete or brush up courses in oxy-acetylene welding & cutting, Manual Arc, TIG, Automatic, Pipe (up & downhill) sheet metal, etc. Precode test training. Request bulletin from—

HOBART WELDING SCHOOL,
BOX HW-411, Troy, Ohio

SALES REPRESENTATIVE

For manufacturer of nationally advertised products distributed through Welding Distributors. Salary and expenses plus monthly bonus, profit sharing, pension, and insurance. Territory: New England and Eastern seaboard. Send resume of experience including earnings to Box 412, c/o WELDING DESIGN & FABRICATION, 812 Huron Rd., Cleveland 15, Ohio.

WELDING or METALLURGICAL ENGINEER

Minimum BS Degree in Engineering, with three years Material and Processes experience in M.I.G. and T.I.G. welding processes on aircraft missile or spacecraft alloys. Will be responsible for development of welding techniques and act as design consultant on welding application for titanium, molybdenum, stainless steel, and other more advanced exotic metals. Prepare technical reports and specifications for welding processes.

If interested and qualified in the above position, please forward your experience resume, in confidence, to:

R. E. Kaletta
Supervisor, Engineering Employment P. O. Box 516, St. Louis 66, Mo.

McDONNELL

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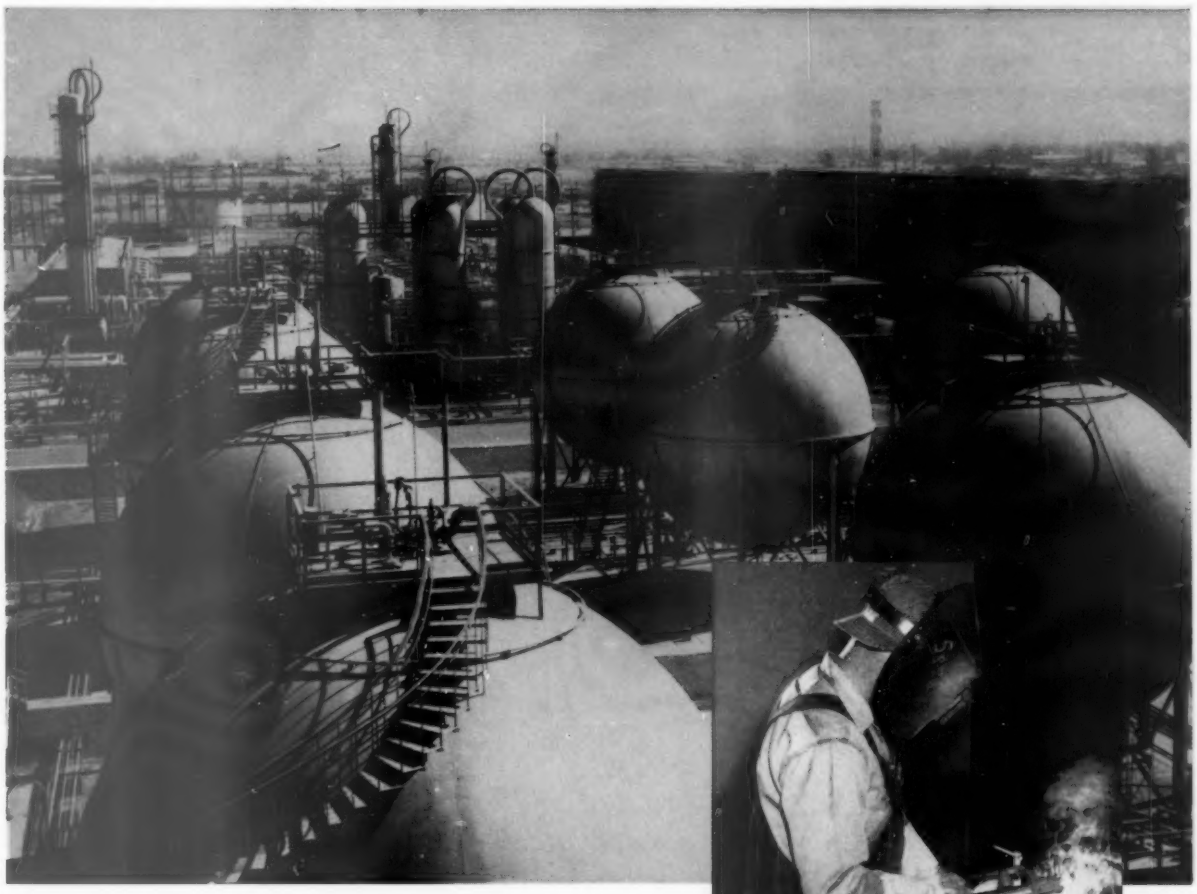

SHELL CHEMICAL COMPANY

uses CADDY®

ARC WELDING ACCESSORIES

CADDY K-25 Electrode Holder being used on maintenance welding at Torrance, California SHELL CHEMICAL COMPANY plant.

SHELL CHEMICAL COMPANY, one of the Nation's top chemical producers, has the only fully integrated Styrene-Butadiene Rubber plant in the United States.

Typical of the chemical manufacturing industry, potentially hazardous conditions exist in many areas of their plant. Safety is essential.

CADDY Arc Welding Circuits, including: lugs, splices, TAPER-LOK quick connectors and K-25 electrode holders are used because of the high quality of the CADWELD CONNECTIONS. All connections are vulcanized to insure absolute safety in all areas of the plant.

CADDY® Arc Welding Accessory Div.

Erico Products, Inc.

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- **VERSATILE**—for use in school, farm, small shop or contractor on the move . . . for welding, brazing, soldering, heating.
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- **COMPACT**—only 21¾" x 14¼" x 10" in size.
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90 AMP	180 AMP	205 AMP	295 AMP	200 AMP DC
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For More Information Circle No. 40 on Reader Service Card.